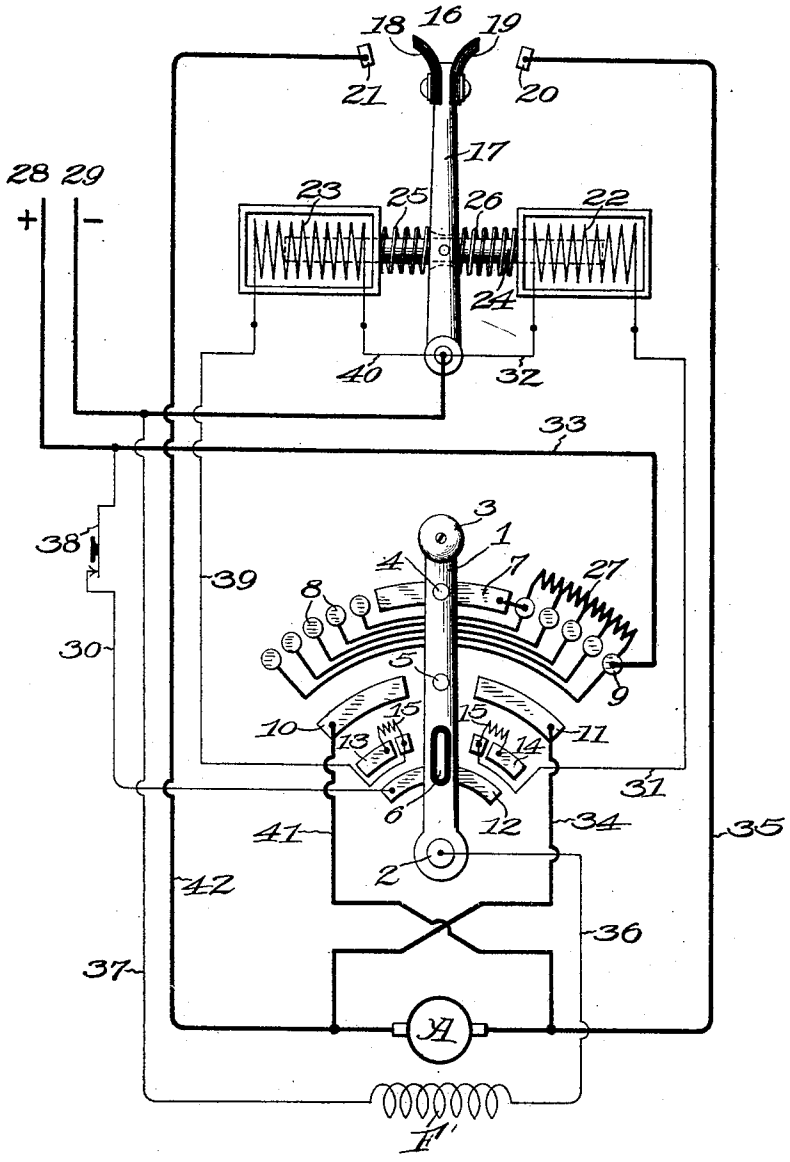
P. H. ZIMMER.

MOTOR CONTROLLER.

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1,119,384. Patented Dec. 1, 1914.



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MOTOR-CONTROLLER.

1,119,384. Specification of Letters Patent. Patented Dec. 1, 1914.

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To all whom it may concern:

Be it known that I, PAUL H. ZIMMER, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Motor-Controllers, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to improvements in motor controllers.

More particularly, my invention relates to devices in which a single controlling element is employed to control a resistance in the motor circuit, and also to control the direction of operation of the motor. In devices of this kind, as heretofore constructed, it has been necessary to provide the controlling element with numerous insulated contacts in order to prevent short-circuits.

It is one of the objects of my invention to reduce the number of contacts on the controlling element and particularly the number of insulated contacts thereon.

A further object of my invention is to provide an automatic main switch under the control of the resistance varying element for making and breaking the motor circuit and for coöperating with said element to control the direction of the flow of current through the motor.

A still further object of my invention is to provide means for maintaining the main switch open until the resistance element is returned to a predetermined position, should said main switch be deënergized while said element is in any other position.

My invention has various other objects and advantages which will be hereinafter set forth.

For the purpose of more fully disclosing the nature and characteristic features of my invention, I shall describe the controller which is diagrammatically illustrated in the accompanying drawing. Of course, it should be understood that my invention is susceptible of various modifications.

The controller illustrated includes a movable element 1 preferably fulcrumed on a pivot 2. The member 1 may be provided with a suitable operating handle 3. Carried by the member 1 are contact brushes 4, 5 and 6, the first two of which are electrically connected with said member, while the latter is suitably insulated therefrom. In a central position of the member 1, the brush 4 is adapted to engage a contact segment 7, disposed between two series of contacts 8 and 9, over which the brush 4 is adapted to sweep when the member 1 is moved in opposite directions from the central position. The brush 5 is adapted to be moved into engagement with either contact segment 10 or contact segment 11, said segments being so arranged that when the member 1 is in central position, the brush 5 will be disposed between the same and out of engagement therewith. One end of the brush 6 is in continual engagement with a contact segment 12, while the other end thereof is adapted to engage either contact segment 13 or contact segment 14, said last mentioned segments being so disposed that when the member 1 is in central position, the upper end of said brush 6 will be disposed between the same and out of engagement therewith. For a purpose hereinafter set forth I prefer to divide each of the segments 13 and 14 into two parts and to electrically connect said parts through a resistance 15.

In addition to the device described, the controller illustrated also includes a main switch 16, which, in practice, may be of any preferred type. As illustrated, this switch comprises a pivoted member 17, provided, at its end, with two contact brushes 18 and 19. The brush 19 is adapted to engage with contact 20, while the brush 18 is adapted to engage with contact 21. The contacts 20 and 21 are spaced a sufficient distance apart to permit the switch member 17 to be moved into such a position that its contact brushes will be out of engagement with both of said contacts. For operating the switch member 17, I have shown a pair of electromagnetic windings 22 and 23, which are diagrammatically illustrated as provided with a common core 24 having a pivotal connection with the member 17. From such an arrangement it will be seen that when the magnet 22 is energized, the switch member 17 will be moved to the right, thereby causing its contact brush 19 to engage the contact 20; whereas, when the winding 23 is energized, the member 17 will be so operated as to cause its contact brush 18 to engage the contact 21. In practice, I desire to have the switch arm 17 biased to a central position out of engagement with both con-

tacts, and, for accomplishing this result, I have provided centering springs 25 and 26.

The controller is illustrated as controlling an electric motor, having an armature A and a shunt field winding F. It should be understood, however, that my invention is not limited in its application to any particular type of motor.

As will be hereinafter set forth, the contact 6 of the movable element 1 coöperates with contact segments 13 and 14 to control the circuits of the windings 22 and 23 of the switch 16, while the brush 5 coöperates with the contact segments 10 and 11 and with the switch 17 to reverse the flow of current through the motor armature. The contact brush 4 coöperates with the contact buttons 8 and 9 to control a starting or regulating resistance 27, connected in series with the motor armature.

I shall now describe the operation of the controller, at the same time clearly setting forth the circuit connections therefor. Assuming that current is supplied from main lines 28 and 29, and that the switch arm 17 and resistance varying element 1 are in the position illustrated, no current will flow through the motor. The motor may be started by moving the arm 1 in either direction according to the direction in which it is desired to cause the motor to operate. Assuming that the arm 1 is moved to the right, circuit will first be closed from main line 28 by conductor 30 to contact segment 12, through contact 6 of the arm 1, to contact segment 14, by conductor 31, through the operating winding 22, by conductor 32 to main line 29. Thereupon the winding 22 responds, moving the switch arm 17 to the right until the contact brush 19 thereof engages contact 20. This results in closing the motor circuit which may be traced as follows: from main line 28, by conductor 33, through the resistance 27, contact brush 4 and arm 1, to contact brush 4 and contact segment 11, by conductor 34, through the motor armature, by conductor 35, through switch arm 17 to the main line 29. As illustrated, the shunt field winding F′ is permanently connected in circuit, its circuit being traced from main line 28, by conductor 33, through the resistance 27, to contact segment 7 and thence through the arm 1 by conductor 36, through said field winding, by conductor 37 to main line 29. Hence, as soon as the armature circuit is closed in the manner described, the motor will commence to operate but with all of the resistance 27 inserted in circuit therewith.

While I have shown the field winding permanently connected in circuit, it should be understood that so far as my invention is concerned, this point is immaterial. By continued movement of arm 1 to the right, the resistance 27 is gradually removed, thereby accelerating the motor. During this movement, the contact brush 6 carried by the arm 1 moves on to the second portion of the contact segment 14, thereby inserting the resistance 15 in circuit with the operating winding 22 of the switch arm 17. The resistance 15 is so designed as to reduce the flow of current through the winding 22 to an amount sufficient to hold the switch arm 17 in the position to which it has been moved, but insufficient to operate said switch arm. The purpose of this arrangement is to prevent operation of the switch arm 17 to close the motor circuit unless the resistance arm 1 is in a position to include resistance in the armature circuit for the protection of the motor. With such an arrangement I am enabled to use one or more normally closed push buttons 38 connected in circuit with the winding 22 by means of which said winding may be deënergized at any time irrespective of the position of the resistance varying element 1 without danger of the motor being restarted while unprotected. Of course, as soon as the winding 22 is deënergized the spring 24 returns the switch arm to open position, thereby opening the motor circuit.

To stop the motor by operation of the resistance arm 1, it is only necessary to return said arm to initial position which results in reinserting the resistance 27, then deënergizing the winding 22, whereupon the switch arm 17 is moved by the spring 26 to open the motor circuit. In practice, I preferably so arrange the contact segment 14 that it will be disengaged by the arm 1 before said arm disengages the contact segment 11. This insures the breaking as well as the making of the motor circuit by the switch arm 17, thereby eliminating the danger of arcing on the rheostat panel. To cause the motor to operate in the opposite direction, it is merely necessary to move the arm 1 to the left. Upon initial movement of the arm 1 in this direction, circuit is closed from main line 28, by conductor 30 to contact segment 12, across contact brush 6 of the arm 1, to contact segment 13, by conductor 39, through the winding 23, by conductor 40 to main line 29. The winding 23 thereupon responds, moving the switch arm 17 to the left until the contact brush 18 engages contact 21. This results in completing the motor circuit from main line 28, by conductor 33, through the resistance 27, to the first of the series of contacts 8, through arm 1 to contact segment 10, by conductor 41, through the motor armature, by conductor 42, through the switch arm 17 to main line 29.

With the circuit connections just described, it will be noted that current is sent through the motor armature in an opposite direction to that previously described. The

flow of current through the field winding, however, remains the same; and, consequently, the motor will operate in an opposite direction to that previously described. Further movement of the arm 1 to the left gradually removes the resistance 27 from circuit, thereby accelerating the motor. Such continued movement of the arm 1 to the left causes the insertion of the resistance 15 in circuit with the winding 23. The purpose of this resistance is the same as that of the resistance connected to contact segment 14. The push button 38 is included in the circuit of winding 23 as well as in the circuit of winding 22, and, consequently, may be operated to stop the motor regardless of the direction in which it is operating. The arrangement of contact segments 10 and 15 is preferably the same as the arrangement of the contact segments 11 and 14 to insure making and breaking of the motor circuit by the switch arm 17.

With the arrangement described, it will be seen that the switch arm 17 is capable of connecting either terminal of the motor armature to main line 29, while the resistance arm 1 is capable of connecting either terminal of the motor armature to main line 28. Thus both arms coöperate to control the direction of flow of current through the motor armature, and, consequently, obviates the necessity of using double pole switches or a plurality of insulated contacts to accomplish reversal of the motor.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a motor controller in combination, a rheostat and electroresponsive means conjointly and dependently controlling the direction of operation of the motor, the movable element of said rheostat controlling said electroresponsive means, and the position of said element determining the direction of operation of the motor and means preventing operation of said electroresponsive means except when said rheostat is in a position to protect the motor.

2. In a motor controller in combination, a rheostat and electroresponsive means conjointly and dependently controlling the direction of operation of the motor, the movable element of said rheostat controlling said electroresponsive means, and the position of said element determining the direction of operation of the motor, said electroresponsive means being controlled by said rheostat to finally make and first break the motor circuit.

3. In a motor controller, in combination, a resistance varying element, electroresponsive means for making and breaking the motor circuit, said means having a plurality of operating windings controlled by said resistance varying element, said element being operable in opposite directions to cause the motor to operate in opposite directions, and means for preventing response of said electroresponsive means except when said resistance controlling element is in a position to protect the motor.

4. In a motor controller in combination, a resistance controlling element, electroresponsive means for making and breaking the motor circuit, said means having a plurality of operating windings separately controlled by said resistance varying element, said resistance varying element and said means conjointly and dependently controlling the direction of operation of the motor, and circuit connections whereby the resistance controlling element need only be provided with one insulated contact.

5. In a motor controller, in combination, electroresponsive means for connecting either terminal of the motor armature to one of the supply lines, and a resistance varying element adapted to connect either terminal of the motor armature to the other supply lines and for controlling the energizing circuits of said electroresponsive means to cause the motor to operate in either direction.

6. In a motor controller, in combination, electroresponsive means for connecting either terminal of the motor armature to one of the supply lines and a resistance varying element adapted to connect either terminal of the motor armature to the other supply lines and for controlling the energizing circuits of said electroresponsive means to cause the motor to operate in either direction, said electroresponsive means being adapted to make and break the motor circuit for starting and stopping.

7. In a motor controller, in combination, a resistance controlling element, electroresponsive means controlled thereby for making and breaking the motor circuit and arranged to coöperate therewith to control the direction of operating the motor, and means necessitating movement of said element to a predetermined position prior to energizing said electroresponsive means.

8. In a motor controller, in combination, a resistance controlling element, electroresponsive means controlled thereby for making and breaking the motor circuit and arranged to coöperate therewith to control the direction of operating the motor, means necessitating movement of said element to a predetermined position prior to energizing said electroresponsive means, and a switch adapted to be operated to deënergize said electroresponsive means to stop the motor irrespective of the position of said resistance controlling element.

9. In a motor controller, in combination, a resistance, a controlling element movable in opposite directions from a central posi-

tion to remove said resistance from circuit, an electroresponsive switch biased to a central position and movable in either direction therefrom to close the motor circuit, said switch being controlled by said element and adapted to move in one direction or the other in accordance with the movement of said element, said switch and said element being arranged to coöperate to control the direction of operation of the motor and means insuring the inclusion of said resistance in the motor circuit prior to closure of said switch.

10. In a motor controller, in combination, a resistance, a controlling element movable in opposite directions from a central position to remove said resistance from circuit, an electroresponsive switch biased to a central position and movable in either direction therefrom to close the motor circuit, said switch being controlled by said element and adapted to move in one direction or the other in accordance with the movement of said element, said switch and said element being each adapted to connect one side of the supply circuit to either terminal of the motor armature.

11. In a motor controller in combination, a main switch movable to different positions to connect one side of the supply circuit to either terminal of the motor, a pair of operating windings therefor, and a rheostat comprising two sets of contacts and a controlling element movable in opposite directions from an intermediate position to engage said sets of contacts, each set of contacts comprising a series of resistance contacts and two segments, said element having a contact insulated therefrom to coöperate with one segment of each set to control the windings of said switch and electrically connected contacts coöperating with the resistance contacts and the remaining segment of each set to connect either terminal of the motor to one side of the supply circuit.

12. In a motor controller in combination, a main switch movable to different positions to connect one side of the supply circuit to either terminal of the motor, a pair of operating windings therefor and a rheostat comprising two sets of contacts and a controlling element movable in opposite directions from an intermediate position to engage said sets of contacts each set of contacts comprising a series of resistance contacts and two segments, said element having a contact insulated therefrom to coöperate with one segment of each set to control the windings of said switch and electrically connected contacts coöperating with the resistance contacts of each set and the remaining segment to connect either terminal of the motor to one side of the supply circuit, the winding controlling segments of said rheostat being formed in sections and resistances interposed between said section to render said windings ineffective to close said main switch after said element has moved beyond certain limits.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

PAUL H. ZIMMER.

Witnesses:
FRANK H. HUBBARD,
E. W. WUSSOW.