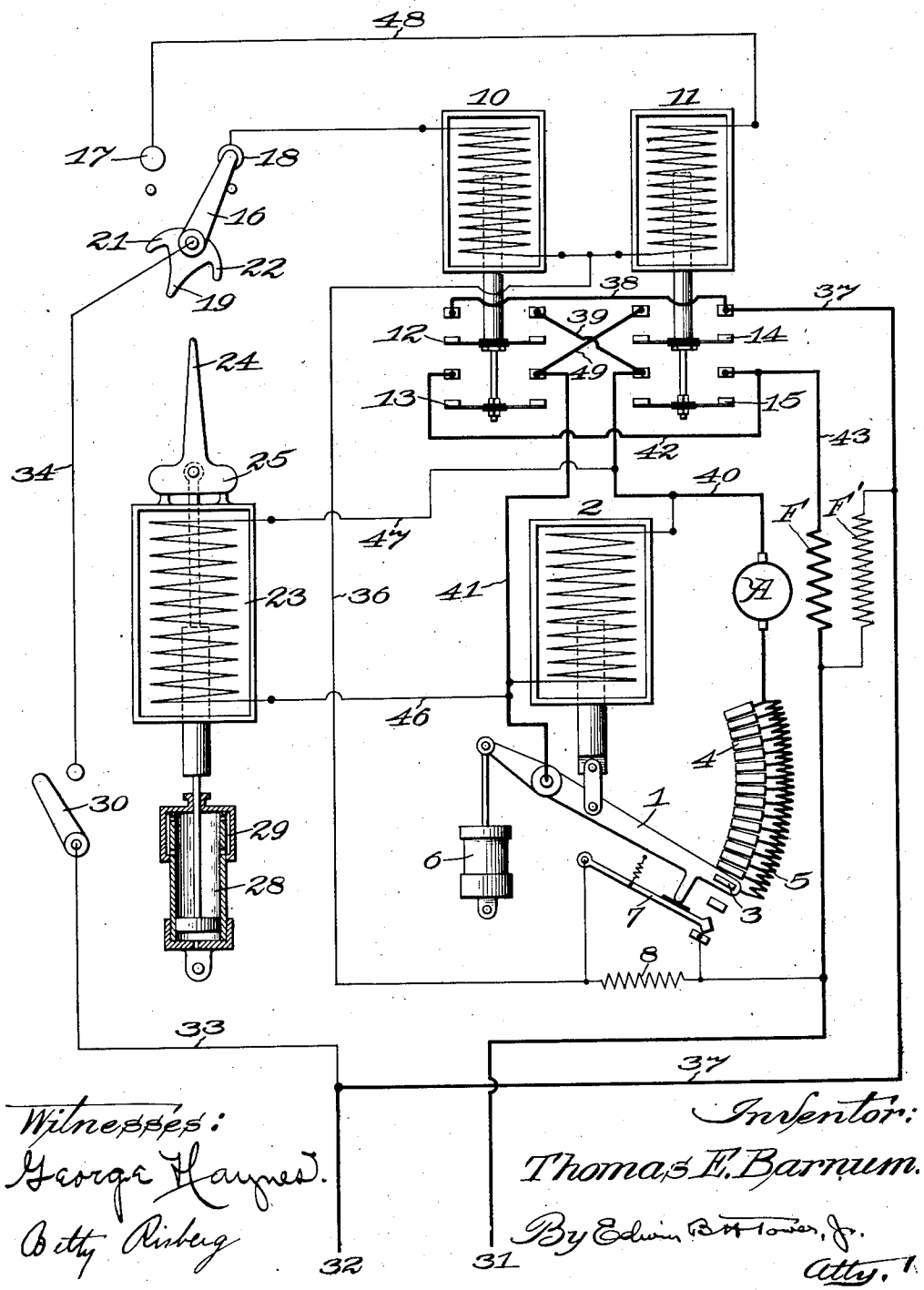
T. E. BARNUM.

MOTOR CONTROLLER.

APPLICATION FILED JULY 25, 1910.

1,027,796. Patented May 28, 1912.



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UNITED STATES PATENT OFFICE.

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MOTOR-CONTROLLER.

1,027,796. Specification of Letters Patent. Patented May 28, 1912.

Application filed July 25, 1910. Serial No. 573,750.

To all whom it may concern:

Be it known that I, THOMAS E. BARNUM, 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 controllers for electric motors.

The principal object of my invention is to provide a controller for periodically reversing electric motors entirely automatically.

A further object of my invention is to provide an automatic reversing controller which will be governed by an intermittently energized electro responsive device which may be regulated to vary the number of revolutions the motor may make in either direction.

Various other objects and advantages of my invention will be hereinafter fully and clearly set forth.

Controllers embodying my invention are particularly adapted for use with motor operated washing machines and other devices where it is desired to change the direction of the operation of the driven mechanism automatically at given times.

For the purpose of disclosing the nature and characteristic features of my invention I shall describe the controller diagrammatically illustrated in the accompanying drawing which embodies my invention in its preferred form.

The motor to be controlled is illustrated as being of the compound wound type having an armature A, a series field winding F and a shunt field winding F'. For accelerating the motor, I have provided a rheostat having a pivoted arm 1 provided with an operating solenoid 2. The arm 1 carries a contact brush 3 adapted to sweep over a series of contacts 4 to which is connected a variable resistance 5. The rheostat is also provided with a suitable dash pot 6 for retarding the movement of the arm 1 when the solenoid 2 is energized. It should be understood, however, that any other preferred form of an accelerating device might be employed in lieu of the one illustrated. For the purpose hereinafter described, I have provided the rheostat with auxiliary switch 7 biased to move to open position and adapted to be moved to closed position by the arm 1 when the same is in initial position. The switch 7 controls a resistance 8.

For controlling the continuity of the motor circuit and the direction of the flow of current through the motor armature, I have provided two electro responsive switches 10 and 11. The switch 10 is provided with two movable contact members 12 and 13 each arranged to bridge a pair of stationary contacts. The switch 11 is also provided with similar movable contacts 14 and 15 each adapted to bridge a pair of stationary contacts. For controlling the circuits of the switches 10 and 11, I have provided a pivoted switch member 16 having coöperating stationary contacts 17 and 18. The switch member 16 is adapted to be turned on its pivot to move the same into engagement with either contact 17 or contact 18. The switch member 16 is provided with a tapered extension 19 arranged to be thrown to one side or the other of the pivotal point of said switch member when the same is moved from one of its stationary contacts to the other. The switch member 16 is also provided with lateral extending lugs 21 and 22. For operating the switch 16, I have provided a solenoid 23, the plunger of which carries a pivotal extension 24 having a weighted portion 25 biasing said pivoted portion to a position directly in alinement with the pivotal point of the switch 16. This switch is of the same general construction as the switch forming the subject matter of my prior application, Serial No. 491,701, filed April 23, 1909. In said prior application the structure and mode of operation of the switch is clearly and fully explained.

Briefly described, the operation of the switch is as follows: Assuming the switch member 16 to be in the position illustrated, upon energization of the solenoid 23, the pivoted extension 24 of its plunger would be guided by the tapered portion on said switch member into engagement with the lug 22, thereby causing said switch member to be moved into engagement wth contact 17. The switch member 16 would remain in this position until the solenoid 23 was again energized, whereupon the tapered extension 19 would guide the pivoted extension of the plunger of said solenoid into engagement with the lug 21, thereby return-

ing the switch member 16 into engagement with the contact 18. For the purpose hereinafter described, I desire to retard the movement of the plunger of solenoid 23 and for accomplishing this, I have provided a dash pot 28 having its piston connected to said plunger. The dash pot, of course, may assume any preferred form. A suction dash pot would prove efficient in practice. It is desirable, however, to eliminate all retardation of the solenoid plunger, as it reaches the limit of its movement, in order to insure quick operation of the switch member 16. I, therefore, preferably provide the dash pot with a suitable by-pass 29 so located as to permit free ingress of air into the dash pot as its piston approaches the limit of its upward movement. The magnetism of the solenoid having by this time reached its maximum will cause its plunger to impart a hammer-like blow to the switch member 16, thereby causing it to quickly break circuit. For controlling the circuits of the several solenoids to start and stop the motor at will I have provided a manually operated switch 30.

I shall now describe the operation of the controller at the same time setting forth the circuit connections therefor and the functions of the several switches Assuming that current is supplied from main lines 31 and 32, if the switch 30 be open the several solenoids will be deënergized and the motor will be at rest. Upon closure of the switch 30, assuming that the switch 16 is in the position illustrated, circuit will be closed from main line 32 by conductor 33 through said switch 30 by conductor 34 through the switch 16 and through the operating winding of switch 10 by conductor 36 through the auxiliary switch 7 of the rheostat to main line 31. Thereupon the switch 10 will respond to close the motor circuit. The motor circuit may now be traced from main line 32 by conductors 37 and 38 through the contact member 12 of switch 10 by conductors 39 and 40 through the motor armature A and the resistance 5, thence through the arm 1 of the rheostat by conductor 41 through contact member 13 of switch 12 by conductors 42 and 43 through the series field winding F to main line 31. The shunt field winding F′ is connected directly across the supply line. Hence, upon closure of the switch 10, the motor will be started and it may be assumed to operate in clock-wise direction. The motor, however, at this time will only operate at a slow speed owing to the insertion of the resistance 5. The operating solenoid 2 of the rheostat, however, is connected across conductors 40 and 41, and, hence, when said conductors are connected to the supply lines as above described, said solenoid will respond to move the rheostat arm and thereby gradually remove the resistance 5 from circuit. The motor will thus be brought to normal speed.

Upon initial movement of the rheostat arm, the switch 7 is released and moves to open position, thereby inserting the resistance 8 in series with the operating winding of the switch 10. As will be hereinafter described the energizing circuit of the switch 11 is also initially completed through the auxiliary switch 7 of the rheostat. Hence, upon operation of the rheostat the resistance would be inserted in circuit with the operating solenoid of said switch 11 if the same was energized. The resistance 8 is so designed as to reduce the flow of current through the operating windings of the switches 10 and 11 to an amount just sufficient to maintain the same in closed position, and insufficient to cause the same to respond. This provides an electrical interlock which prevents closure of the motor circuit until the rheostat arm is returned to initial position to afford due protection to the motor. Also upon closure of the motor circuit the solenoid 23, which is connected by conductors 46 and 47 to conductors 41 and 40 respectively, will respond. The operation of the solenoid 23, however, is retarded by the dash pot 28. Hence the solenoid 23 will not operate the switch 16 until a predetermined time has elapsed to allow the motor to make the desired number of revolutions. When the switch 16 is finally operated it breaks the energizing circuit of the switch 10 at contact 18. The switch 10 thereupon opens, thereby disconnecting the motor from circuit. This also tends to deenergize the solenoids 2 and 23. It will be seen, however, that the solenoids 2 and 23 are connected in shunt to the motor armature through the resistance controlling arm 1. Hence, if the motor drifts under the impetus of its load, the motor armature will generate a current which will pass through said solenoids and tend to maintain the same energized until the motor has been slowed down sufficiently to permit reversal of the current therethrough with safety. When the switch 16 is moved out of engagement with contact 18 it is moved into engagement with contact 17, thereby completing a circuit from conductor 34 through said switch 16 by conductor 48 through the operating winding of switch 11 and thence to main line 31 as already traced in connection with switch 10. Thus as soon as the rheostat arm has returned to initial position the resistance 8 will be short-circuited and the switch 11 will respond. When the switch 11 responds circuit is closed from main line 32 by conductor 37 through contact 14 of switch 11 by conductors 49 and 41 through the rheostat arm 1 and resistance 5 thence through the motor armature by conductor 40 through the contact 15 of switch 11 by conductor 43

through the series field winding F to main line 31. It will be seen that under these conditions current flows through the motor armature in a reverse direction to that previously described, while the polarity of the series and shunt fields remains the same. Thus the motor will now be caused to operate in an opposite direction to that previously described, or in an anti-clock wise direction. When circuit is closed through the motor by the switch 11, the solenoids 2 and 23 respond in the same manner as that previously described, thereby bringing the motor up to normal speed, then after the lapse of a predetermined time disconnecting the motor from circuit and reversing the flow of current through the motor armature. It will thus be seen that the motor is periodically reversed, the periods in which the motor operates in one direction or the other being determined by the retardation of the operating solenoid of the switch 16. Obviously, therefore, the operative periods of the motor may be varied by adjusting the dash pot 28 connected to the plunger of the solenoid 23.

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

1. In a controller for electric motors in combination, means for starting the motor in either direction and means controlled by and controlling said first mentioned means to automatically cause periodical reversals of the motor.

2. In a controller for electric motors, in combination automatic means for controlling the continuity of the motor circuit and the direction of operation of the motor and electro responsive means arranged to respond periodically to cause said first mentioned means to periodically reverse the motor.

3. In a controller for electric motors, in combination, automatic means for controlling the continuity of the motor circuit and the direction of operation of the motor and electro responsive means arranged to respond periodically to cause said first mentioned means to periodically reverse the motor, said electro responsive means being controlled by said first mentioned means.

4. In a controller for electric motors, in combination, electro responsive means controlling the continuity of the motor circuit and the direction of operation of the motor and intermittently operating electro responsive means associated therewith for causing the motor to be periodically reversed.

5. In a controller for electric motors, in combination, electro responsive means for starting and stopping the motor and controlling the direction of operation thereof, intermittently operating electro responsive means associated therewith to cause the motor to be periodically reversed, and means insuring the motor being slowed down prior to each reversal thereof.

6. In a motor controller in combination, means for causing the motor to operate in either direction and automatic means for controlling said former means to cause periodical reversal of the motor, said latter means being mechanically independent of the motor but operative only during the periods of operation of the motor.

7. In a motor controller, in combination, automatic means adapted upon successive operations to start the motor alternately in opposite directions, said means tending to operate each time the motor is started, means for retarding the operation of said first mentioned means to insure operation of the motor for a predetermined period prior to each reversal thereof, and means insuring a reduction in the speed of the motor prior to each reversal.

8. In a motor controller, in combination, electro responsive means for controlling the continuity of the motor circuit and the direction of operation of the motor, an electro responsive device adapted upon successive operations thereof to cause said means to start the motor alternately in opposite directions, said device tending to operate each time the motor is started and means for retarding the operation of said device to insure operation of the motor for a predetermined period prior to each reversal thereof.

9. In a motor controller, in combination, electro responsive means for controlling the continuity of the motor circuit and the direction of operation of the motor, an electro responsive device adapted upon successive operations thereof to cause said means to start the motor alternately in opposite directions, said device tending to operate each time the motor is started, means for retarding the operation of said device to insure operation of the motor for a predetermined period prior to each reversal thereof, and means insuring a reduction in the speed of the motor prior to each reversal thereof.

10. In a motor controller, in combination, electro responsive switches for starting and stopping the motor and controlling the direction of operation thereof, an electro responsive device adapted upon successive operations thereof to deënergize certain of said switches and to energize other of the same to stop the motor and start the same in an opposite direction, said device being energized each time the motor is started, and having means for retarding the operation thereof to allow the motor to operate for a predetermined period prior to each reversal thereof.

11. In a motor controller, in combination, electro responsive switches for starting and

stopping the motor and controlling the direction of operation thereof, an electro responsive device adapted upon successive operations thereof to deënergize certain of said switches and to energize other of the same to stop the motor and start the same in an opposite direction, said device being energized each time the motor is started and having means for retarding the operation thereof to allow the motor to operate for a predetermined period prior to each reversal thereof, a resistance controlling device adapted to automatically accelerate the motor and means insuring the return of said resistance controlling device to initial position prior to each reversal of the motor.

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

THOMAS E. BARNUM.

Witnesses:
FRANK H. HUBBARD,
GEORGE HAYNES.