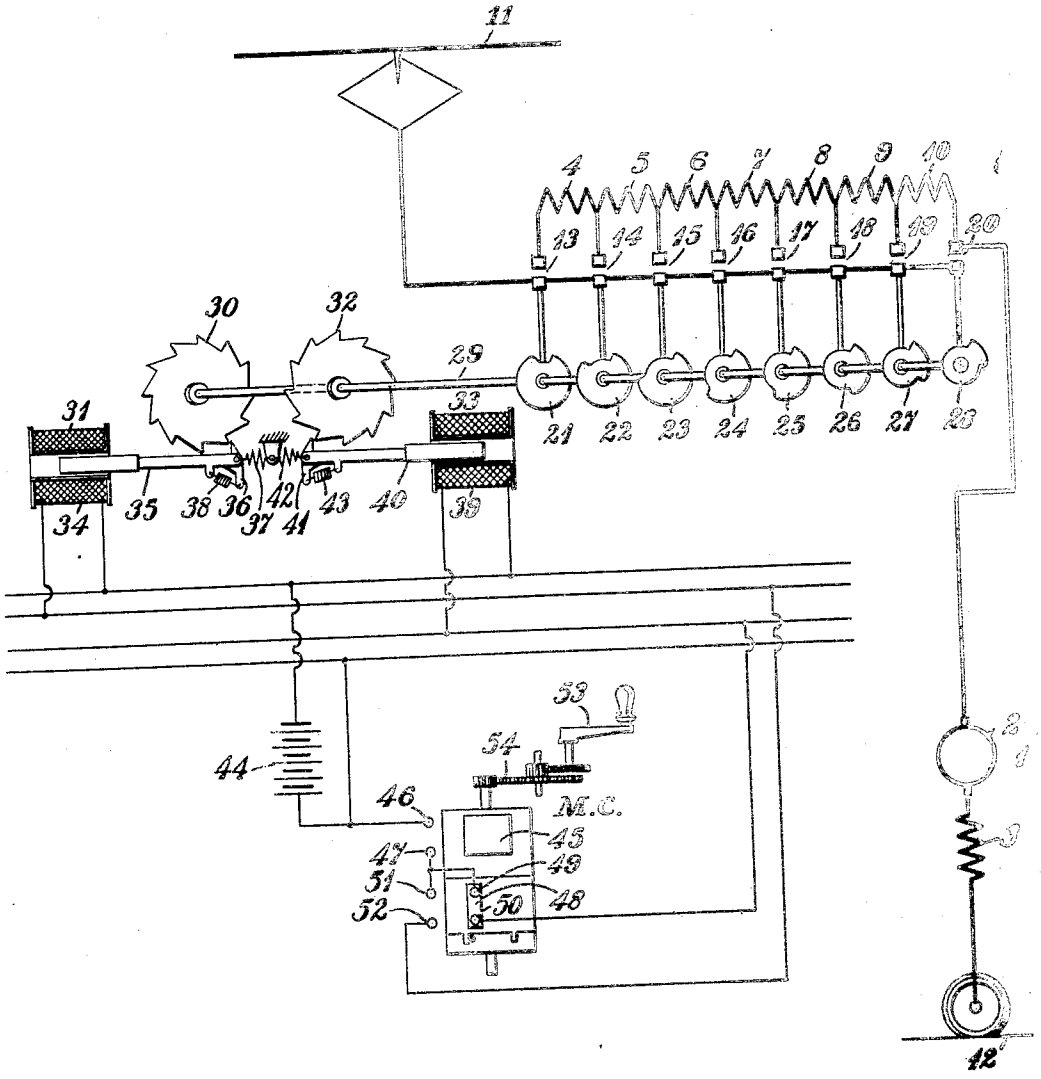
F. H. MILLER.

CONTROL SYSTEM.

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1,341,657.



WITNESSES:

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CONTROL SYSTEM.

1,341,657. Specification of Letters Patent. Patented June 1, 1920.

Application filed March 2, 1917. Serial No. 151,939.

To all whom it may concern:

Be it known that I, FREDERICK H. MILLER, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Control Systems, of which the following is a specification.

My invention relates to systems of control and particularly to systems of control for electric-railway vehicles.

One object of my invention is to provide a control system which shall be simple and rugged in construction and positive and efficient in operation.

Another object of my invention is to provide a control system with a master controller which may be continuously rotated in a forward or in a reverse direction to effect the operation or the release of a plurality of switches.

Another object of my invention is to provide a control system of the above indicated character having a plurality of cam-operated switches for governing the operation of a motor, two ratchet wheels and two electromagnets for rotating a shaft having a plurality of cam members mounted thereon to govern the operation of the motor switches, and a master controller which may be continuously rotated, in a forward or in a reverse direction, for intermittently energizing the one or the other of said electromagnets.

In the prior art, control systems are disclosed wherein a plurality of electrically-operated motor-controlling switches are directly governed by a master controller having a plurality of contact segments arranged in a predetermined relation and an intricate system of auxiliary control circuits for connecting the controller to the various coils of the motor switches.

However, according to my invention, the motor switches are cam operated to effect a reduction in the number of auxiliary control circuits and the cam members, which operate the switches, are controlled by two electromagnets which are intermittently energized by means of a master controller. The master controller is provided with a single contact segment for intermittently governing the energization of the one or the other of said electromagnets, and a slip segment is associated with the controller for preparing the circuit of the one or the other of said electromagnets for operation by the controller according to the direction of rotation thereof.

The single figure of the accompanying drawing is a diagrammatic view of a system of control constructed in accordance with my invention.

Referring to the control system illustrated in the drawing, a motor 1, that is provided with an armature 2 and a field winding 3, is adapted to be connected in series with resistors 4 to 10, inclusive, across a supply circuit comprising a trolley conductor 11 and a ground return conductor 12. A plurality of switches 13 to 20, inclusive, is provided for connecting the motor across the supply circuit and for excluding the resistors 4 to 10, inclusive, from the circuit of the motor, and a plurality of cam members 21 to 28, inclusive, which are mounted upon a shaft 29, are provided for selectively operating the switches 13 to 20, inclusive, in a predetermined order.

A ratchet wheel 30, which is mounted upon the shaft 29, and an electromagnet 31 are provided for operating the shaft 29 and the cam members 21 to 28, inclusive, in a forward direction to successively operate the switches 13 to 20, inclusive. Adjacent to the ratchet wheel 30 is mounted a ratchet wheel 32, which is provided with teeth disposed on the periphery thereof in a reverse direction to the teeth formed on the periphery of the ratchet wheel 32 and is operated by an electromagnet 33 for rotating the shaft 29 and the cam members 21 to 28, inclusive, to release the switches 13 to 20, inclusive.

The electromagnet 31 embodies an energizing coil 34 and a coil 35 which is provided with a pawl 36 near the end thereof for engaging the teeth of the ratchet wheel 30. A spring 37 is provided for returning the core 35 to normal position when the coil 34 is deënergized and a spring 38 is associated with the pawl 36 for maintaining the same in position for engaging the teeth of the ratchet wheel 30. The electromagnet 33 is provided with a coil 39 and a core 40 which is provided with a pawl 41 near the end thereof for engaging the teeth of the ratchet wheel 32. A spring 42 is provided for returning the core 40 to normal position when the coil 39 is deënergized, and a spring

43 is provided for maintaining the pawl 41 in position for engaging the teeth of the ratchet wheel 32.

A master controller MC is provided for intermittently completing a circuit from a battery 44 through the coil 34 or the coil 39, according to the direction of rotation of the master controller. The master controller embodies a contact segment 45 which is adapted to intermittently bridge contact fingers 46 and 47 when continuously rotated in a forward or in a reverse direction. Associated with the master controller is a slip segment 48 of the type disclosed in the patent to N. W. Storer, Serial No. 774,394, filed June 18, 1913, and assigned to the Westinghouse Electric & Manufacturing Co., which is adapted to bridge the contact fingers 49 and 50 when the controller is rotated in a reverse direction and to bridge the contact fingers 51 and 52 when the controller is rotated in a forward direction. An operating handle 53 is connected to the master controller by means of a gearing system 54 which is so constructed that a partial rotation of the handle 53 will rotate the segment 45 a sufficient number of times to intermittently energize the magnet 34 or the magnet 39 for operating or releasing the switches 13 to 20, inclusive.

In case it is desired to connect the motor 1 across the supply circuit and to accelerate the same, the operating handle 53 of the master controller is rotated in a forward direction to effect an intermittent bridging of the contact fingers 46 and 47, by the contact segment 45, and to bridge the contact fingers 51 and 52, by means of the slip segment 48. When the contact fingers 46 and 47 are bridged by the contact segment 45, a circuit is completed through the coil 34 of the electromagnet 31 which may be traced from one terminal of the battery 44 through the contact fingers 46 and 47—which are bridged by the contact segment 45—contact fingers 51 and 52—which are bridged by the slip segment 48—and the coil 34 to the other terminal of the battery 44. Thus, the electromagnet 31 is intermittently energized to rotate the ratchet wheel 30 of the shaft 29 in a step-by-step manner, and the cam members 21 to 28, inclusive, successively operate the switches 13 to 20, inclusive. The switch 13 connects the motor across the supply circuit in series with the resistors 4 to 10, inclusive, and the switches 14 to 20, inclusive, successively exclude the resistors 4 to 10, inclusive, from the circuit of the motor.

When it is desired to break the connection of the motor 1 to the supply circuit, the handle 53 of the master controller is given a partial rotation in a reverse direction for breaking the connection between the contact fingers 51 and 52, for bridging the contact fingers 49 and 50 by the slip segment 48, and for intermittently bridging the contact fingers 46 and 47 by means of the contact segment 45. When the slip segment 48 bridges the contact fingers 49 and 50, a circuit is completed from the battery 44 through the coil 39 of the electromagnet 33, whenever the contact segment 45 engages the contact fingers 46 and 47. Thus the electromagnet 33 is intermittently energized to rotate the ratchet wheel 32, the shaft 29 and the cam members 21 to 28, inclusive, in a reverse direction for releasing the switches 13 to 20, inclusive.

Modifications in the system and arrangement and location of parts may be made within the spirit and scope of my invention, and such modifications are intended to be covered by the appended claims.

I claim as my invention:

1. In a system of control, the combination with a motor and a plurality of switches for governing the operation thereof, of electrical means for successively operating said switches and a continuously rotatable controller for intermittently closing the circuit of said electrical means to effect continuous uni-directional movement of the motor.

2. In a system of control, the combination with two electromagnets and an energizing circuit for each of said electromagnets, of a controller having a slip segment for preparing the circuit of the one or the other of said electromagnets in accordance with the direction of rotation of the controller, and a contact segment for intermittently energizing said electromagnets when the controller is continuously rotated.

3. In a system of control, the combination with a motor, a plurality of switches for governing the operation of said motor, and electrical means for controlling the operation of said switches, of a controller for operating said electrical means to close the switches when continuously rotated in one direction and for operating said electrical means to release the switches when continuously rotated in a reverse direction.

4. In a system of control, the combination with a motor and a plurality of switches for governing the operation of the motor, of means, comprising an electromagnet, for successively operating said switches, and a continuously rotatable controller having a single contact segment for intermittently making and breaking the circuit of said electromagnet.

5. In a system of control, the combination with a motor, a plurality of switches for controlling the operation of said motor, and a shaft having a plurality of cam members mounted thereon for closing said switches in a predetermined order when rotated in a forward direction and for opening said switches when rotated in a reverse direction, of two ratchet wheels and two elec-

tromagnets for rotating said shaft in a forward and in a reverse direction, and a controller, said controller being adapted to be continuously rotated in one direction for intermittently energizing one of said electromagnets and to be continuously rotated in a reverse direction for intermittently energizing the second electromagnet.

6. In a system of control, the combination with a supply circuit and a motor adapted to be connected across the supply circuit, of electrically controlled means for connecting the motor across the supply circuit and for accelerating the same, and a continuously rotatable controller for governing said means in a step-by-step manner and embodying a single segment for making and breaking the circuit thereof.

7. In a system of control, the combination with a controller provided with a slip segment having a forward and a reverse position and a contact segment for intermittently closing a circuit when the controller is continuously rotated, of an electromagnet operated by the controller when the latter is rotated in a forward direction, a second electromagnet operated by the controller when the same is moved in a reverse direction, and a plurality of switches controlled by said electromagnets.

8. In a system of control, the combination with a plurality of cam-operated members, and electrical means for successively operating said members and for releasing the same, of two circuits associated with said electrical means, and a controller having a control segment for intermittently closing the one or the other of said circuits, and a slip segment for preparing said circuits to be intermittently closed by said contact segment.

9. In a system of control, the combination with a plurality of cam-operated members, and two electromagnets for successively operating said members and for successively releasing the same, of a controller having a slip segment and a contact segment, said slip segment preparing the circuit of the one or the other of said electromagnets for intermittent energization by means of the contact segment of the controller.

10. In an electrical system, the combination with a plurality of switches, a shaft having a plurality of cam members mounted thereon for controlling the operation of said switches, an electromagnet and a ratchet wheel for operating said shaft to close the switches, and a second electromagnet and a ratchet wheel associated therewith for operating the shaft to release the switches, of a controller having a single contact segment for intermittently energizing one of said electromagnets when rotated in one direction and for intermittently energizing the other one of said electromagnets when rotated in a reverse direction.

11. In an electrical system, the combination with a plurality of switches, a shaft having a plurality of cam members mounted thereon for successively closing said switches when rotated in one direction and for opening said switches when rotated in a reverse direction, of two ratchet wheels and two electromagnets for rotating said shaft in a forward and in a reverse direction, and a controller for intermittently energizing the one or the other of said electromagnets when continuously rotated in a forward or in a reverse direction.

In testimony whereof, I have hereunto subscribed my name this 23rd day of Feb. 1917.

FREDERICK H. MILLER.