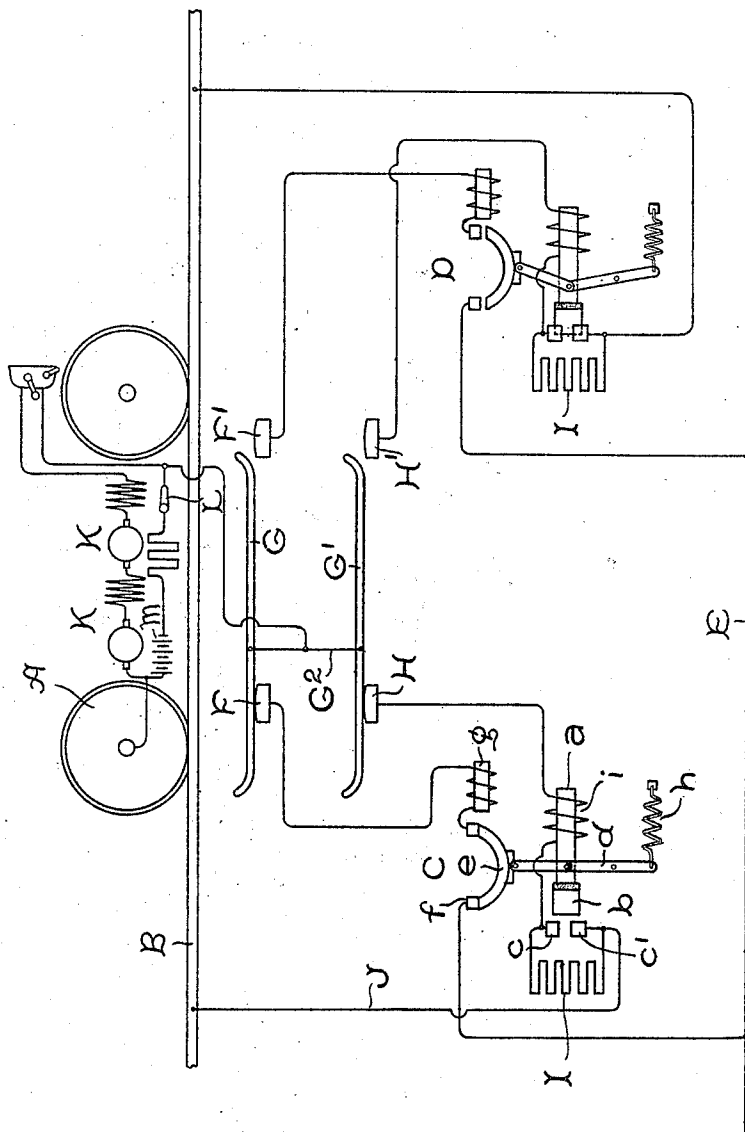


No. 679,314.

Patented July 30, 1901.

E. M. HEWLETT.
ELECTRIC RAILWAY.
(Application filed Oct. 19, 1897.)

(No Model.)



WITNESSES.
E. Williams, Jr.
A. J. Macdonald.

INVENTOR.
Edward M. Hewlett.
by
Geo. R. Blodgett
att'y.

UNITED STATES PATENT OFFICE.

EDWARD M. HEWLETT, OF SCHENECTADY, NEW YORK, ASSIGNOR TO THE
GENERAL ELECTRIC COMPANY, OF NEW YORK.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 679,314, dated July 30, 1901.

Application filed October 19, 1897. Serial No. 655,698. (No model.)

To all whom it may concern:

Be it known that I, EDWARD M. HEWLETT, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Surface-Contact Electric Railways, (Case No. 494,) of which the following is a specification.

My invention relates to improvements in means for operating apparatus electrically, and to clearly disclose the same I illustrate an embodiment of the invention in surface-contact electric railways. It has been heretofore proposed in systems of this kind to permanently include a resistance in circuit with each coil to reduce the current flowing therein; but in many systems, noticeably for heavy high-speed traffic, this is not a satisfactory arrangement, for the switches will not act quickly enough, due to the self-induction of the coils. If the permanent resistance plus that of the coil is sufficient to reduce the amount of current flowing in the coil to a point where there is no danger of its burning out, then a certain interval of time is required for the switch to close, which in high-speed systems requires too great and in some cases an impossible overlap of the contact-shoes.

To overcome the objections above pointed out by winding the switch-magnets with a comparatively small number of turns of wire, and under normal conditions—that is, when no vehicle is passing—connect one terminal of the coil directly to the line conductor and the other to a surface-contact stud; but as soon as a vehicle approaches and closes a switch, resistance is automatically cut into circuit with the switch-coil and remains as long as the particular stud that is connected to the coil continues active. By this arrangement the potential to which the coil is subjected is a maximum while the switch is closing and is so much in excess of the counter electromotive force of the coil that the switch closes instantly, and the resistance that is automatically cut into circuit increases the efficiency of the system by limiting the current flowing through the coil to ground, at the same time preventing overheating of the coil.

In the accompanying drawing I have shown my invention applied to a surface-contact

system, in which A represents a vehicle, B the traffic-rails, and C and D switches for closing the circuit between the feeder E and working studs F, situated in the roadway. On the vehicle are propelling-motors K and connected contact-shoes G and G'. The former makes contact with working conductors F and the latter with energizing or switch-closing studs H. A controller of any suitable construction is provided for the motors, and a switch L is employed to connect the storage battery M in circuit with shoe G' for picking up the switches when for any reason they have dropped. Each switch is provided with a movable core *a*, carrying an insulated contact *b* at its outer end and arranged to bridge the fixed resistance-terminals *c* and *c'*. Surrounding the core is a comparatively small coil of wire *i*, that is connected at one end to stud H and at the other to resistance-terminal *c*. The carrying capacity and also the counter electromotive force of this coil is small, and to permit current at full potential to flow through it for any length of time would waste a large amount of energy, at the same time overheating the coil. To prevent this, as soon as the switch closes resistance I is included in circuit. The resistance may be arranged so that it is cut out the instant contact *e* bridges terminal *f*, or it may be slightly in advance or afterward, the object being to give the magnet-core time to get well under way before the resistance is increased. As it requires considerably more current to start a switch than to hold it closed the current supplied is by my invention made correspondingly large at the start and then reduced. For this reason the overlap of the collecting-shoes on the car can be reduced, and as the switch-coil resistance is not normally in circuit only a low potential auxiliary source of current is required for initially closing a switch when the feeder is not connected to a conductor-section. Connected to the core by a toggle *d* is a contact or switch piece *e*, arranged to bridge contacts *f* and complete the circuit between feeder E and contact-stud F. In circuit with one of the contacts is a blow-out magnet *g* to disrupt arcs formed at this point. A spring *h* is employed to return the parts to the posi-

tion shown in right-hand switch D. Connected to terminals *c* and *c'* is a resistance I, and connecting contact *c'* and resistance I with grounded rail B is a wire J.

- 5 The operation of my invention is as follows: Assuming the vehicle to be moving from left to right, the coil *i* of switch C is energized to hold the switch closed by a shunt-current from shoe G, which passes by connection G² 10 to shoe G', contact-stud H, coil *i*, terminal *c*, resistance I, wire J, to rail B and ground. As the vehicle advances to a point where shoe G' rests on stud H' a shunt-current will pass through the switch-coil, attract its core, and 15 close the circuit to stud F', at about the same time cutting resistance I into circuit by the withdrawal of the contact on the core from the two stationary contacts. As soon as the vehicle leaves a pair of contact-studs the circuit is automatically interrupted and the resistance short-circuited.

The invention is not necessarily limited to the herein-described shunt-magnet-railway system nor to an embodiment in any type of 25 railway, but relates, broadly, to electrically-operated apparatus of any kind.

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

1. In an electromagnetically - controlled 30 switch, the combination with relatively movable contacts for making and breaking a circuit, of an energizing-coil for the switch, and a resistance which is normally out of circuit, but is included in circuit with the coil independently of the position of the switch by the 35 movement of the latter after it has started to close.

2. In a surface-contact electric-railway system, the combination with conductor-sections 40 situated in the roadway, of electromagnetic switches for connecting the sections with the source of supply, resistance included in circuit with each of the switch-coils, and an automatic switch for cutting said resistance 45 into and out of circuit.

3. In a surface-contact electric-railway system, the combination with conductor-sections situated in the roadway, of electromagnetic switches for closing the circuit between the 50 sections and the source of supply, and a resistance normally out of circuit, but which is included in circuit after a switch-coil has been energized.

4. In a surface-contact electric railway, the 55 combination with conductor-sections situated in the roadway, of electromagnetic switches for closing the circuit between the source of supply and the sections, energizing-coils on the switches permanently connected to 60 ground, and switches for automatically increasing the resistance of the circuits of the electromagnet-coils after the electromagnetic switches have started to close.

5. In a surface-contact electric railway, the 65 combination with conductor-sections situated in the roadway, electromagnetic switches for closing the circuit between the source of sup-

ply and the sections, energizing-coils on the switches permanently connected to ground, and a contact actuated by the core of the 70 magnet for short-circuiting a resistance when the switch is open, and including it in circuit when the switch is closed.

6. In a surface-contact electric railway having a shunt pick-up, the combination with 75 working conductor-sections normally disconnected from the feeder, of shunt-energizing conductor-sections permanently connected to ground through switch-coils, contact-shoes carried by the vehicle and making contact 80 with the sections, contacts actuated by the switch for closing the circuit between the working conductor-sections and the feeder, and a resistance normally short-circuited, but included in the switch-coil circuit after the 85 switch has been energized.

7. In a surface-contact electric-railway system, the combination with electrical conductors for supplying current to the traveling motors, of line-switches in the circuit between the sectional conductors and feeder or 90 source of supply, magnet-coils in shunt-circuits receiving the full, or substantially the full, line potential for closing the line-switches, special resistances in the shunt-circuits, and means whereby said special resistance is out of circuit when the corresponding 95 line-switch is open, but automatically brought into circuit when the line-switch is closed.

8. The combination with an electric switch, 100 of an electromotive device for actuating said switch, and means controlled by said motive device independently of the position of the switch for reducing the amount of current which flows through the energizing-circuit of 105 the motive device after it has imparted the initial movement to said switch.

9. The combination with an electric switch, of an electromotive device for actuating said switch, and means controlled by the switch 110 for reducing the amount of current which flows through said device.

10. The combination with a normally open electric switch, of an electromotive device adapted to quickly move said switch toward 115 its closing position, and means operating independently of the position of the switch whereby a smaller current flows through said electromagnetic device after the switch has been moved than that flowing when said motive device has been moving said switch. 120

11. The combination with an electric switch which is required to be moved and maintained for a time in the position to which it has been moved, of an electromotive device for moving 125 said switch and maintaining it in the desired position, and means controlled by said switch whereby a smaller current flows through said electromagnetic device after it has moved said switch toward the desired position. 130

12. The combination with an electric switch which is required to be moved and maintained for a time in the position to which it has been

moved, an electromotive device for moving said switch and maintaining it in the desired position, and means controlled by said switch for reducing the current flowing through the circuit of said electromotive device at any time after it has imparted motion to said switch.

13. In an electric-railway system, the combination with a feeder, of a sectional working conductor, a set of switches, each adapted to close the circuit between said feeder and a section of said conductor, a set of electromotive devices, each adapted to control one of said switches, and means operating independently of the position of a switch whereby a smaller current flows through the circuit of the electromagnetic device which operates said switch after the switch has received its primary actuation.

14. In an electric-railway system, the combination with a feeder, of a return, a sectional working conductor, a shunt-circuit from a point between the feeder and the car-motors, through a section of said energizing-conductor to the return, a set of switches each adapted to close a circuit between the feeder and a section of said working conductors, a set of electromotive devices each adapted to control one of said switches, and itself controlled by said shunt-circuit, and means whereby a smaller current flows through the circuit of said electromotive device after the switch has received its primary actuation.

15. The combination with an electric switch which is required to be moved and maintained for a time in the position to which it has been moved, of an electromotive device for moving said switch and maintaining it in the desired position, and a resistance which is cut into the circuit of said electromotive device independently of the position of said switch by means of said switch.

16. In an electric-railway system, the combination with a feeder, of a sectional working conductor, a set of switches each adapted to close a circuit between said feeder and a section of said conductor, a set of electromotive devices each adapted to control one of said switches, and a set of resistances each of which is adapted to be cut into the circuit of one of said electromagnetic devices independently of the position of the switch which it operates, by means of said moving parts during the movement thereof.

17. The combination with an electric switch adapted to be held normally open, an electromagnet for closing the said switch and holding it closed for a time, and a resistance which is cut into circuit with a coil of said magnet independently of the position of said switch by means of a body which is moved by said coil.

18. The combination with a normally open electric switch, of an electromagnet for closing said switch, a resistance in series with the coils of said magnet, a secondary switch normally closing a shunt around the said re-

sistance, said secondary switch being also controlled by said electromagnet.

19. The combination with an electric switch, of an electromagnet for controlling the switch, in shunt to the circuit controlled by the switch, and a resistance which is inserted in series with the coil of said magnet after the magnet has moved the switch.

20. The combination with a primary electric switch, of an electromagnet for controlling the switch and in shunt to the circuit controlled by said switch, a resistance, and a secondary switch which is controlled by the said magnet to insert said resistance in series with the magnet-coil after the magnet has moved the primary switch.

21. The combination with an electric switch, of an electromotive device which controls said switch, and a switch in the circuit of said device, which is also controlled by the movement of the first switch.

22. The combination with a resistance having a broken short-circuited connection, of a switch which normally closes said connection, an electromotive device in series with the resistance, which device opens said switch, and a switch in the circuit of said device, which is closed by the latter.

23. A sectional railway having switches connecting its sections with the feeder, and electromagnet-coils supplied with current from the feeder, for operating said switches, resistances in series with said coils, and having broken short-circuited connections, and switches normally closing said connections, and opened by said coils when the latter are energized to close the feeder-switches.

24. The combination with the feeder-switches of a sectional-conductor electric railway, of electromotive devices supplied with current through closed feeder-switches, to close the advance switches as the car proceeds, resistances, and means for cutting one of said resistances into the circuit of an electromotive device when the latter has actuated its switch.

25. The combination with the feeder, of conductor-sections, switches for connecting the latter with the former, electromagnets for actuating said switches, and supplied in normal operation by current from the feeder, and resistances which are cut into the circuits of the respective magnet-coils by the respective switches in closing, whereby the switches are closed with certainty and positiveness and held closed by only a small current.

26. In a railway, the combination with the feeder, of conductor-sections, switches for connecting the latter with the former, electromagnets for actuating said switches, and supplied in normal operation by current from the feeder, collecting means carried by the car, an independent source of low-potential current which initially energizes an electromagnet when the feeder is not connected to the conductor-section engaged by the collecting means, and resistances which are cut into

the circuits of the electromagnets by the switches in closing, whereby only a low-potential independent or auxiliary source of current is required to initially energize the magnets, and whereby during the progress of the car the switches are actuated with certainty and positiveness, and held closed by only a small current.

27. In combination, a feeder, a conductor-section, a feeder-switch for connecting the section with the feeder, a second conductor-section, said sections being adapted to be connected by a car-collecting device, a coil connected with the second section for closing said feeder-switch, a resistance in the circuit of said coil, a switch which normally short-circuits said resistance and is adapted to be actuated by said coil to include the resistance in series with the coil.

28. The combination with the feeder-switches of a sectional-conductor railway, of electromotive devices connected in branches around the car-motors and adapted to close the feeder-switches, resistances, and means for automatically inserting the resistances in series with the electromotive devices as the switch is closed.

29. The combination with a feeder-switch, of an electromotive device for closing the same, a resistance for the circuit of said device, which resistance is short-circuited by the switch in its open position, and is cut into the device-circuit by the closing movement of the switch.

30. The combination with a feeder-switch, of a coil for closing the same, and a resistance which is cut into the coil-circuit by the closing movement of the switch.

31. The combination with an electric switch, of an electromotive device for closing the switch, said device being in the circuit closed by the switch, and a resistance which is cut into circuit with the device by the closing movement of the switch.

32. The combination with an electric switch, of an electromotive device for closing the switch, which device is connected in the circuit closed by the switch, a resistance, and means controlled by the switch whereby the resistance is cut into the circuit of said device.

33. The combination with a toggle, of a switch-piece mounted on an end of the toggle,

and a second switch-piece mounted intermediately the ends of the toggle.

34. The combination with an electric switch, of an electromotive device for actuating the switch, a resistance, and means controlled by the switch for cutting resistance in series with the coils of the electromotive device.

35. The combination with an electric switch, of an electromotive device for actuating the switch, a resistance, and means controlled by the movement of the switch for cutting the resistance in series with the coils of the electromotive device.

36. The combination with an electric switch, of an electromotive device for actuating the switch, a resistance connected with the coils of said device, and a shunt around the resistance, which shunt is normally closed by said switch, but is opened when the switch is actuated by said device.

37. The combination with a switch provided with contacts for controlling an electric circuit, of an electromotive device for moving said switch, a resistance, and an auxiliary contact carried by said switch by which, when the switch is moved by the electromotive device, the resistance is inserted in series with the coils of said device.

38. The combination with a switch for an electric circuit, of an electromotive device for actuating said switch, a branch from the circuit of said device, a resistance in said branch, and a switch in the circuit of and controlled by the coils of said device.

39. The combination with an electric switch, of an electromotive device for moving the switch, a resistance, and means controlled by the electromotive device for cutting the resistance in series with the coils of said device after the latter has moved the switch.

40. The combination with an electric switch, of an electromotive device for moving the switch, a resistance, and means whereby when the device is energized it moves the switch, and also inserts the resistance in series with its own coils.

In witness whereof I have hereunto set my hand this 13th day of October, 1897.

EDWARD M. HEWLETT.

Witnesses:

B. B. HULL,
M. H. EMERSON.