



# UNITED STATES PATENT OFFICE.

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## AUTOMATIC CIRCUIT-BREAKING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 662,049, dated November 20, 1900.

Application filed August 24, 1898. Serial No. 689,391. (No model.)

*To all whom it may concern:*

Be it known that I, GRANVILLE T. WOODS, a citizen of the United States, and a resident of Monsey, in the county of Rockland and State of New York, have invented certain new and useful Improvements in Automatic Circuit-Breaking Apparatus, of which the following is a specification.

My invention relates to improvements in automatic circuit-breaking apparatus used in connection with sectional contact electric railways; and the object of my improvements is to automatically interrupt the action of the driving-motor on the moving car whenever a pick-up switch fails to open the circuit after the car has passed off that section. Thus the motor-driver will be compelled to attend to said switch and also to the interrupting apparatus on the car. I attain this object by the mechanism illustrated in the accompanying drawing, in which—

G is the main generator.

A and B are the mains.

P and P' are the pick-up magnets.

1 and 2 are the working contacts.

3, 4, 5, 6, 7, and 8 are supplemental or pick-up contacts.

M is the driving-motor.

S is the main contact-shoe.

T indicates the test contact-shoe.

C is the controller, which is in electrical connection with the motor M, test contact-shoe T, and the car-wheel 16.

D is a normally-open circuit pick-up battery.

E is a circuit-closer which is to be operated by hand.

The operation of the system is as follows: Suppose the car to be moving from left to right. When shoe S passed from working contact 1, the switch of magnet P' failed to act and open the circuit, and as the movement of the car caused test contact-shoe T to touch working contact 1 a short-circuit was made from main A, through fuse 9, switch 10, lower coil of magnet P', conductor 11, working contact 1, test-shoe T, conductor 12, magnet 13, conductor 14, fuse 15, car-wheel 16, rail 17, and conductor 18, to main B. The abnormal current flowing over this short-circuit blows fuses 9 and 15, and magnet 13

moves switch 19, thus opening the motor-circuit at several points. The motor being deprived of current compels the car to stop until repairs are made. Then to start the car circuit-closer E is caused by hand to momentarily connect with supplemental contact 6 or 7. Then current will flow from pick-up battery D over circuit-closer E, contact 6 or 7, conductors 20 and 21, pick-up or upper coil of magnet P, and conductor 22 to main B, thence over conductor 18, rail 17, wheel 16, fuse 15, controller C, motor M, switch 19, and over shoe S back to the battery D. Then magnet P moves switch 23, thereby closing the circuit from main A, through switch 23, lower coil of magnet P, conductor 24, working contact 2, shoe S, switch 19, motor M, controller C, wheel 16, rail 17, and conductor 18, to main B.

It will be observed that the supplemental contacts are connected together in pairs, but arranged out of alinement with the working contacts, the arrangement being such that when the car moves in either direction the shoe extensions 26 and 27 will make a temporary connection with the supplemental contacts and a portion of the current taken from the mains by shoe S will be shunted through the appropriate supplemental contact and pick-up coil of the magnet which is to close the circuit in advance of the car.

It will be observed that motor M, as shown in the drawing, is just being deprived of current by the automatic circuit-breaking apparatus because of a defective switch.

I claim as my invention—

1. In an electric-railway system, of the character described, the combination with the sectional conductors or contacts, of electromagnetic switches for controlling the flow of current thereto, of an automatic circuit-breaker carried by the car and connected in the motor-circuit and a normally-open test-circuit, substantially as described.

2. In an electric-railway system of the character described, the combination with the sectional conductors or contacts, of electromagnetic switches for controlling the flow of current thereto, an automatic device carried by the car, and means whereby said device will be caused to interfere with the work of

the car-motor when a preceding switch fails to break the appropriate circuit, substantially as described.

3. In an electric-railway system, of the character described, the combination with the electromagnetic switches having their pick-up coils in circuits branching across the mains and normally energized by currents flowing (across the mains) through said branch circuits, an electrical source carried by the car, and means for cutting said source into circuit with the pick-up coils at starting, substantially as set forth.

4. In an electric railway, the combination with the feeder, of a sectional conductor, electromagnetic switches for connecting the sections thereof with the feeder, an electromagnetic switch for the motor-circuit carried by the car, and a test-contact connected with said switch and adapted to engage with the sections of said sectional conductor, whereby the switch is actuated when the electromagnetic switch for the section engaged by the conductor fails to open.

5. In an electric railway, the combination with the feeder, of a sectional conductor, electromagnetic switches for connecting the sections thereof with the feeder, and means carried by the car for breaking the motor-circuit when one of said switches fails to open.

6. In an electric railway, the combination with the feeder, of a sectional conductor, electromagnetic switches for connecting the sections thereof with the feeder, and an electromagnetic switch on the car which opens the motor-circuit when an electromagnetic switch fails to open.

7. In an electric railway, the combination with the feeder, of a sectional conductor, electromagnetic switches, a car-motor, a collector, a switch between the motor and collector, a test-contact, a controller connected to the test-contact and with the motor and ground, and a coil in the connection between the controller and test-contact, which coil opens the switch between the motor and collector when the test-contact engages a conductor-section which is connected to the feeder.

8. In an electric railway, the combination

with the feeder, of a sectional conductor, electromagnetic switches for connecting the sections thereof with the feeder, coils in series with the car-motors for keeping said switches closed, and coils in shunt to the car-motors and cooperating with said series coils to close the switches.

9. In an electric railway, the combination with the feeder, of a sectional conductor, electromagnetic switches for connecting the sections thereof with the feeder, means for energizing said switches to hold them closed, and means cooperating therewith to close said switches.

10. In an electric railway, the combination with the feeder, of a sectional working conductor, electromagnetic switches for connecting the sections thereof with the feeder, coils for the switches and connected with the sections of said working conductor, an auxiliary sectional conductor, coils for the switches and connected with the sections of said auxiliary conductor, and a collector carried by the car and adapted to engage a working-conductor section and an auxiliary-conductor section simultaneously to close a switch, and then immediately pass off from the auxiliary-conductor section.

11. In an electric railway, the combination with the feeder, of a sectional working conductor, electromagnetic switches for connecting the sections thereof with the feeder, an auxiliary sectional conductor, the sections of which are laterally disposed with respect to the sectional working conductor, two coils for each switch and connected with the sections of said sectional conductors respectively, and a collector carried by the car and having a longitudinal portion adapted to engage the sections of the working conductor, and a transverse portion adapted to engage the sections of said auxiliary conductor.

Signed at New York, in the county of New York and State of New York, this 31st day of August, A. D. 1892.

GRANVILLE T. WOODS.

Witnesses:

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