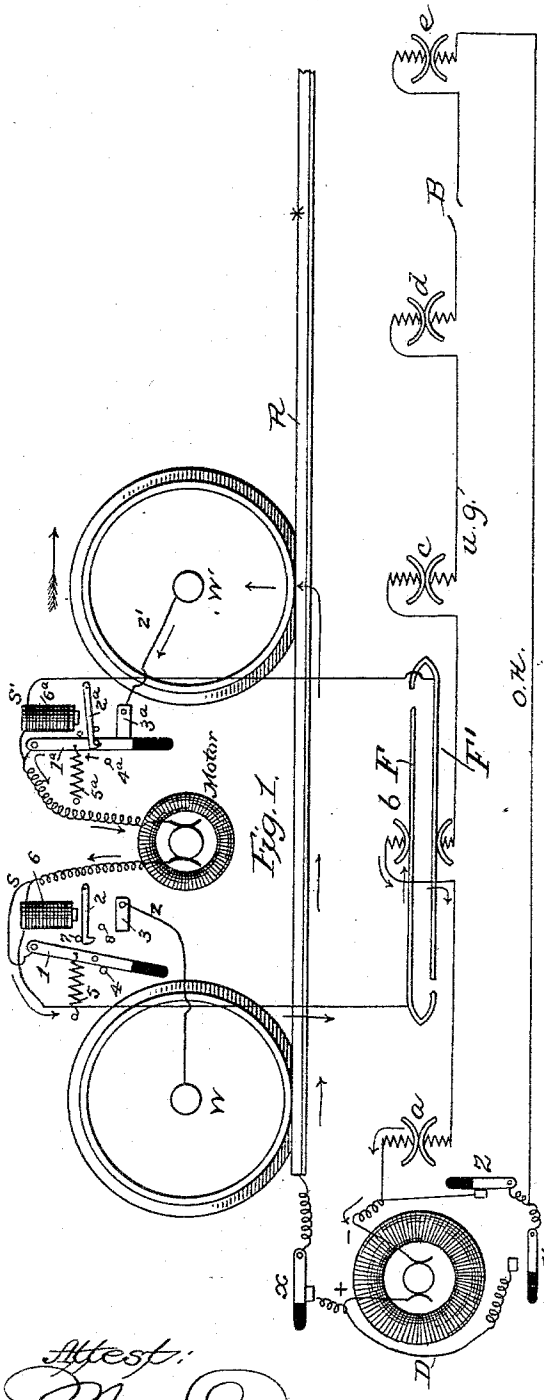
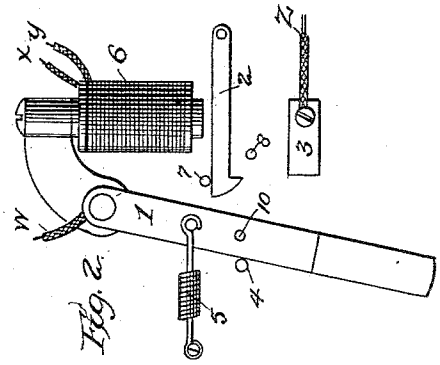
(No Model.)

S. H. SHORT.

ELECTRIC RAILWAY.

No. 401,221. Patented Apr. 9, 1889.





Attest:
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UNITED STATES PATENT OFFICE.

SIDNEY HOWE SHORT, OF DENVER, COLORADO, ASSIGNOR TO THE UNITED STATES ELECTRIC COMPANY, OF SAME PLACE.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 401,221, dated April 9, 1889.

Application filed February 17, 1887. Serial No. 227,950. (No model.)

To all whom it may concern:

Be it known that I, SIDNEY HOWE SHORT, of Denver, in the county of Arapahoe and State of Colorado, have invented a new and useful Improvement in Electric Railways; and I do hereby declare that the following is a full, clear, and exact description of the same.

My invention is an improvement in electric railways, and is designed especially for use in connection with a railway in which the cars are run in series—as, for instance, as shown in Letters Patent of the United States No. 348,476, dated August 31, 1886. In that patent is shown a sectional conductor with contact-faces between the sections adapted to be separated by the passage of a current-collector, which diverts the current through the motor on the car. In practice in running cars on the series system it has been found that under some conditions of weather the spring contact-faces will become separated by the lodgment of some foreign substance between the faces, thus forming an insulation and breaking the circuit, and it also happens that from other causes a break in the circuit is sometimes formed, which would interrupt the working of the road if some means were not provided to run the cars in multiple arc until the break was found and repaired.

It is therefore the object of my invention to provide, in connection with the conductors of a series electric road, means by which the main and return wires may be placed in parallel with one terminal of the generator and the track in connection with the other terminal, with electrical connections from the rails of the tracks to the motor and from the motor to the conductors of the series system, whereby the cars during a break in the circuit may be run in multiple arc upon either side of the break. I also provide automatically-operating switches upon the car, by means of which a connection is made from the rails to the motor of the car and through the motor to the generator through the main conductor or the return-wire, depending upon which side of the break the car happens to be.

Another object is to provide means for stopping the car at the place where the break occurs, this being done automatically, so that the place may be indicated on the rail and repaired.

My invention also consists in the details of construction of the switches used upon the car, all of which I will describe fully hereinafter.

In the accompanying drawings, Figure 1 represents the circuit of an electric railway with a portion of the track and of a car mounted thereon, carrying a motor and my improved switches, the generator being also shown with switches for connecting the generator with the main conductor and its return in series or in multiple arc with the rail of the track, as desired. Fig. 2 is an enlarged detail view of one of the switches.

In the drawings I have shown the conductor *u g* and the return O H with the spring contact-faces *a b c d e* and the current-collector substantially as in my patent above referred to, and when the return-wire O H is in connection through the switch *y* with one terminal of the generator the road is adapted to be used to run the cars in series with each other.

In case the circuit *u g* O H is interrupted or broken from any cause whatever—as, for instance, a break at B—this will be indicated at the station, and the operator will at once open the switch *y* and connect the return-wire O H with the same terminal of the generator to which the conductor *u g* is connected by means of the switch *z*, and this will place the conductor *u g* and the return O H in parallel. The switch *x* is then closed also, being in connection with the rail R of the track at one end and with the contact-block at the other end, which is in electrical connection with the other terminal of the generator.

It will be understood that the rail R may represent one of the rails of the track, or an independent rail may be provided, if desired.

In order to provide for the running of the cars in multiple arc, I arrange at the front and rear of the car in a position to be under the control or within reach of the operator switches S S′, interposed between the terminals of the motor on the car and connections to the rail R and to the current-collector. These switches are the same at both ends of

the car, and the same figures are used to designate similar parts, with the exception that one set have the letter *a* added.

In Fig. 2 I have represented one of the switches on an enlarged scale. This consists of an electro-magnet, 6, supported upon a suitable bracket, and to an arm of this bracket is pivoted a lever, 1, which is normally pressed outwardly against a stop, 4, by a spring, 5. The armature of the magnet is shown at 2, and when any current is passing through the coil of the magnet the armature is kept in an elevated position against the stop 7; but when no current is passing the armature will fall to the stop 8. This armature has a hooked outer end, and is adapted to engage with a stop, 10, on the lever 1 when it has been shifted inwardly against the tension of its spring to make connection with the rail R. A block, 3, electrically connected with the axle, and through the car-wheel with the rail R, is in position to make contact with the lever 1 when it is pushed inwardly, as on the right of Fig. 1.

Both switch-levers being normally closed and in contact with the blocks 3 and 3^a, respectively, with the switches at the generator in the position shown in Fig. 1, the current will pass out through the rail R, through the wheel W and the connection *z* to the block 3, through the switch-lever 1 to the wire leading to the motor, and thence through the path of least resistance—namely, the coil 6 and its terminal—to the side F of the current-collector, and from thence to the generator. The passage of the current through the coil 6 will immediately act upon the armature 2 to draw it against the stop 7, and thereby release the lever 1, which will be drawn back out of contact with the block 3 by its spring, and this will break the circuit through this switch. The current, however, finds another passage through the car-wheel W′ and its wire *z*′, block 3^a, lever 1^a, and to the motor on the car without passing through the coil 6^a. From the motor the current passes through the coil 6 to the side F of the current-collector and from thence to the generator. The circuit described continues without interruption until the car passes the contact faces *d*; but as soon as the collector passes out of contact with these faces it will be seen that the circuit will be broken between the side F of the collector and the generator and the car will come to a stop. This will indicate that the break is at this point, and the car-driver will then mark the place, so that the break may be repaired. He will then close the switch S on the rear of the car, (supposing the car to be going in the direction of the arrow,) and the current will then pass through the wheel W, the connections *e*, the lever 1, around the coil 6 to the motor, and from the motor to the side F′ of the current-collector, which will then be in contact with the contact-faces *e*, one of which will be in connection with the generator through the return-wire O H. When the break is repaired, the current will pass normally through the current-collector strip F F′ and through the magnet-coils on both switches, both switch-blades being removed from their contacts, the ground-contacts being also removed, if desired, and the switches, *x*, *y*, and *z* at the power-station being placed in the position first described.

It will be seen that while it is necessary to close the switch-blades 1 and 1^a when the current is to be directed by way of the wheel W of wheel W′ that the releasing of these switches is automatic.

I claim as my invention—

1. In combination with the main and return conductor of a series electric railway, a generator therefor, and a current-collector, movable connections from the terminals of the generator to connect one of the said terminals with the main and return conductors of the railway, and the other terminal of the generator with a rail, as R, connections from said rail to the motor, and interposed switches on the car between said rail and motor, with connections between said switches and the motor on the car, and between said switches and the current-collector, substantially as described.

2. In combination with a car and electric motor carried thereby, connections between said motor and the rail and between said motor and the current-collector, with interposed switches on the car between the rail and the motor, a generator, a rail in connection therewith, and conductors arranged in parallel, substantially as described.

3. In combination with the car, a motor carried thereby, connections from said motor to the rail and to the current-collector, an interposed switch, a main conductor in connection with one terminal of the generator, a return-wire, O H, switches *y z*, for changing the connection of the said return-wire from one terminal to the other of said generator, and a switch, *x*, for connecting the rail with the generator, substantially as described.

4. In combination with a generator, the conductors *u g* O H in connection with one terminal, a rail, R, in connection with the other terminal, a motor on the car, a connection between the rail and the motor and a connection between the motor and the current-collector, a spring-actuated switch on the car between one terminal of the motor and the rail, an electro-magnet adapted to release said switch, and thus automatically short-circuit the motor, a second switch between the other terminal of the motor and the rail, and connections from said rail to said motor through the said switch, and connections from the other terminal of said motor to the current-collector, substantially as described.

5. In combination with the generator, conductors arranged in parallel in connection with one terminal, a rail in connection with the other terminal, electrical connections from the rail to the motor on the car, an interposed

switch-blade for making or breaking this connection, a connection between the motor and the current-collector, an electro-magnet interposed, and an armature automatically operated by the passage of the current through the electric magnet to break the connection from the rail to the motor, substantially as described.

6. In combination with the system of electrical railway described, a switch consisting of an electro-magnet interposed between the motor and the current-collector, a pivoted lever, 1, a contact-block, 3, electrically connected to the rail, and the pivoted armature 2, adapted to engage with the lever 1, substantially as described.

7. In combination with the main and return conductor of a series electric railway, a generator therefor, and a current-collector, movable connections from the terminals of the generator to connect one of said terminals with the main and return conductor of the railway and the other terminal of the generator with a rail, as R, and connections from the rail to the motor and from the motor to the current-collector, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

SIDNEY HOWE SHORT.

Witnesses:
RODNEY CURTIS,
HARRY R. BURNS.