

(No Model.)

R. M. HUNTER.  
ELECTRIC RAILWAY.

No. 497,024.

Patented May 9, 1893.

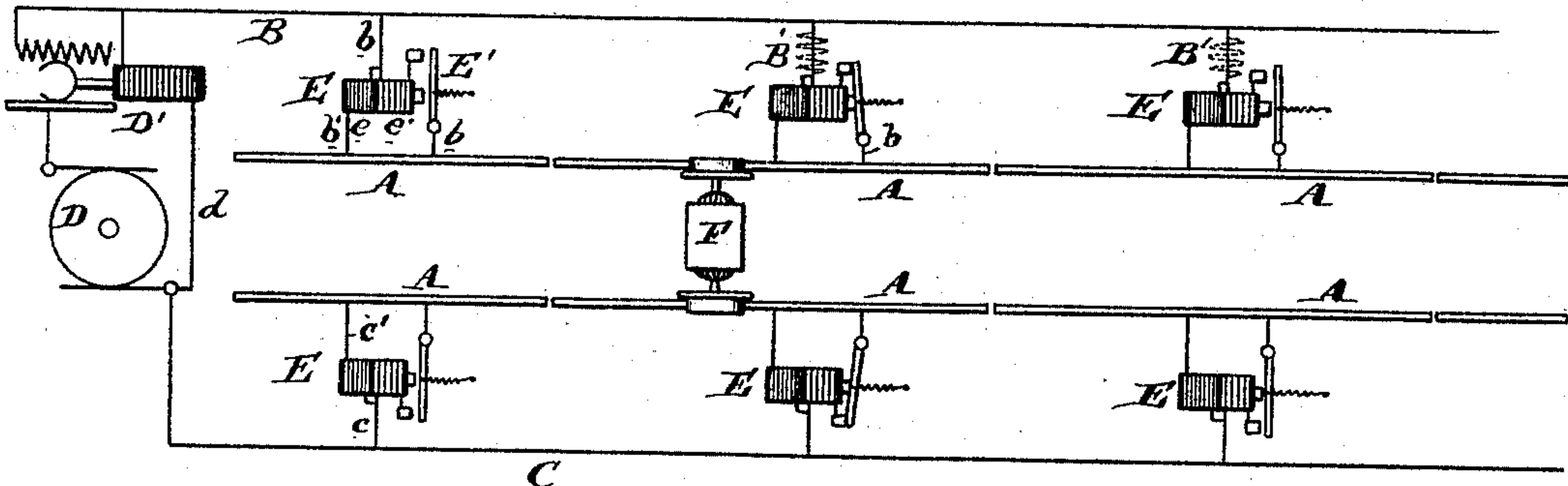


FIG. 1

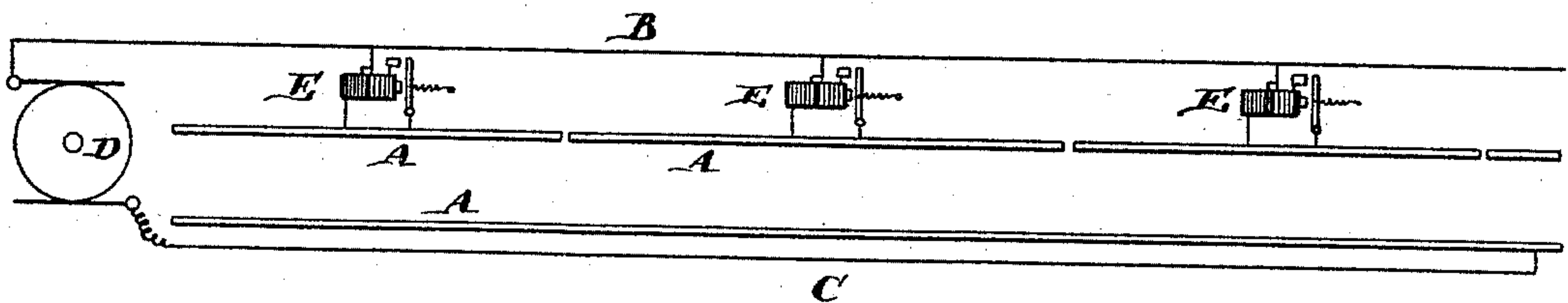


FIG. 2

Witnesses:

Henry D. [Signature]  
Maurice H. Holmes

Inventor:

[Signature]

# UNITED STATES PATENT OFFICE.

RUDOLPH M. HUNTER, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO  
THE THOMSON-HOUSTON ELECTRIC COMPANY, OF CONNECTICUT.

## ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 497,024, dated May 9, 1893.

Original application filed June 21, 1886, Serial No. 205,770. Divided and application filed June 20, 1889, Serial No. 314,893.

Again divided and this application filed May 14, 1890. Serial No. 351,741. (No model.)

*To all whom it may concern:*

Be it known that I, RUDOLPH M. HUNTER, of the city and county of Philadelphia and State of Pennsylvania, have invented an Improvement in Electric Railways, of which the following is a specification.

My invention has reference to electric railways; and consists of certain improvements which are fully set forth in the following specification and shown in the accompanying drawings which form part thereof.

This application, Case No. 142, is a division of my application, Serial No. 314,893, filed June 20, 1889, Case No. 101, which in turn was a division of my application, Serial No. 205,770, of June 21, 1886.

In my application filed July 14, 1885, Serial No. 171,625, among several others is described a construction of railway in which the working conductor sections, (be they the rails or separate conductors) are connected to main supply conductors by branch circuits. In this application I provide the same general construction, but in said branch circuits I locate switches or circuit breakers so that the said sections may be connected or disconnected from the supply conductors as desired, and the said circuit breakers are worked automatically by the movements of a train or electrically propelled vehicle. These circuit breakers are electrical, the particular construction being immaterial to my invention, which comprehends broadly the application of an electrical switch of any description for uniting a working conductor section with a supply conductor. The object of such a construction may be either to prevent escape of electricity or injury to animal life. First, in a surface road the working conductor sections may be formed of the rails, or be exposed, and normally there will be little or no current passing over them, hence all danger to animal life is prevented; and secondly the supply conductors may be insulated so as to prevent leakage of electricity, and may be supported upon poles above the ground, or in tubes, pipes or conduits in the ground, and the current from these supply conductors be

conveyed to a working conductor (which is naturally more or less exposed to atmospheric influence, dampness and moisture, which have a tendency to cause leakage), but the said current is only fed to said working conductors, at the time of the passage of a motor or train over the said conductor section. By this means I overcome danger and at the same time enable currents to be carried over a long distance of an electric railway without danger of excessive leakage.

The foregoing gives a general outline of the invention set out in this application and which is clearly shown in the drawings and specifically described hereinafter in referring thereto.

In the drawings:—Figure 1 is a plan view representing an electric railway embodying my improvements, and Fig. 2 is a similar view illustrating a modification of my invention.

A represents the working conductors which are formed in sections in part or in whole and may be either the rails separate working conductors suspended above the surface of the ground or arranged in a conduit. These sections are connected to supply conductors B and C by branch connections *b* in which the switches or circuit breakers E are located.

D is the generator and supplies electricity to the conductors B and C.

D' is a resistance changer or current regulator and is adapted to regulate the line current in accordance with the demand. If desired one line of these conductor sections A may be continuous as shown in Fig. 2 and the supply conductor E directly connected thereto at the end nearest the generator or more preferably at the end farthest from the generator as set forth in my application, Serial No. 171,625, filed July 14, 1885, as in that case the resistance to the current for a motor anywhere upon the line would be uniform. In this construction shown in Fig. 2, the continuous return conductor A, which is connected by the circuit C with the source of electric energy D, might be the rails and earth while the working conductor A supply-



ing the positive current might be suspended or supported in any suitable manner so as to be thoroughly insulated from the return circuit.

5 If rails are used as the working conductors a series of these rails should be positively connected together in a suitable manner to preserve the continuity of the joints and at the same time allow for expansion and  
10 contraction of the rails and that point between the sections of rails so arranged that they should be thoroughly insulated; but in the case of conductor sections made separate from the rails they may be formed of any  
15 suitable metal of good conductivity and with facing of copper or bronze.

It is immaterial to my invention how these switches are constructed but I prefer that shown as being effective and at the same time  
20 most positive in its action. These switches consist of a high resistance helix  $e$  and a low resistance helix  $e'$ , of which the high resistance helix is in a shunt circuit  $b$  around the low resistance magnet and connecting the  
25 supply conductor with the working conductor section, and the low resistance helix is in the branch circuit, which is broken by the armature  $E'$  attracted by the helices. Fig. 1 will illustrate the operation of these automatic  
30 switches; in which  $F$  represents a car closing a circuit between two sections  $A$  of different polarity and in which it will be seen that the circuit closing levers corresponding to such sections are drawn forward so as to complete  
35 the branch circuits  $b$  completing the circuit through the low resistance helices  $e'$ . As soon as the motor passes to the next section the switches open and the circuit through the high resistance helices in the next section  
40 will be completed in the motor and this will attract the armature closing levers  $E'$  and complete the circuits  $b'$  and  $c'$  through the low resistance magnets of this section as before. It will be noticed that the low resistance helix  
45 will retain the armature  $E'$  in a closed condition and form a path for the current so long as the motor is upon its section and thereby protect the high resistance helices from becoming burned or destroyed.

50 To obtain a uniform resistance in the line circuit through the motors for various positions of the motor upon the line, in place of the construction hereinbefore described resistance  $B'$  may be interposed in the branch  
55 circuits  $b$  or  $c$  or both as indicated in dotted lines Fig. 1 and as set out in my application of July 14, 1885. In place of these resistances the helices  $e$  and  $e'$  may have their resistances so proportioned as to accomplish this result.

60 When no train is passing, the circuit closing levers  $E'$  will break the branch circuits  $b$  and  $c$  and the sections will be coupled with a supply conductor only through the high resistance helices  $e$  which prevent any material  
65 current passing to the sections, and by leak-

age to the earth, until a motor passes upon a section, and thereby prevents any excessive loss by leakage, and there is no great danger due to contact with the conductor section.

The details may be greatly modified to suit the view of the constructors of the railways. Therefore I do not limit myself to the specific construction shown.

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

1. The combination in an electric railway of a sectional line conductor extending along the railway, a supply conductor also extending along the railway, electrical switches connecting the supply conductor with the respective sections of the sectional conductor to permit a large flow of current therein upon the passing of a vehicle, a stationary source of electric supply, an automatic regulator to control the current delivered to the supply conductor, and a return circuit also extending along the railway and connecting with the source of supply.

2. The combination in an electric railway of a sectional line conductor extending along the railway, a supply conductor also extending along the railway, electrical switches connecting the supply conductor with the respective sections of the sectional conductor to permit a large flow of current therein upon the passing of a vehicle, a stationary source of electric supply, a return circuit also extending along the railway and connecting with the source of supply, and a regulator for controlling the current supplied to the supply conductor from the source of electric energy.

3. In an electric railway the combination of a working conductor extending along the railway divided into two or more sections insulated from each other and from the earth, a generator of electricity, a positive supply conductor extending from the generator of electricity and connected at intervals with the sectional conductor, circuit controllers in the connecting circuits between the supply conductor and the sectional working conductor whereby the current for actuating an electrically moved vehicle may be permitted to traverse said branch or connecting circuits only when said vehicle is passing in electrical connection with the respective sections, a regulator to control the current delivered to the supply conductor, and a return circuit extending along the railway and connecting with the source of electric energy.

4. In an electric railway, the combination of a working conductor extending along the railway divided into two or more sections insulated from each other and from the earth, a generator of electricity, a positive supply conductor extending from the generator of electricity and connected at intervals with the sectional conductor, and circuit controllers in the connecting circuits between the sup-



ply conductor and the sectional working  
conductor consisting of an electro-magnetic  
switch having a normally open coarse wire  
circuit controlled by the armature of the  
5 switch and a closed fine wire or shunt cir-  
cuit permanently closed around the normally  
open coarse wire circuit by the armature of  
the switch.

In testimony of which invention I have  
hereunto set my hand.

R. M. HUNTER,

Witnesses:

ERNEST HOWARD HUNTER,  
S. T. YERKES.