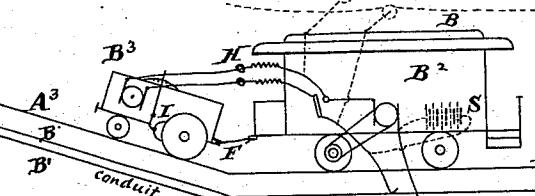
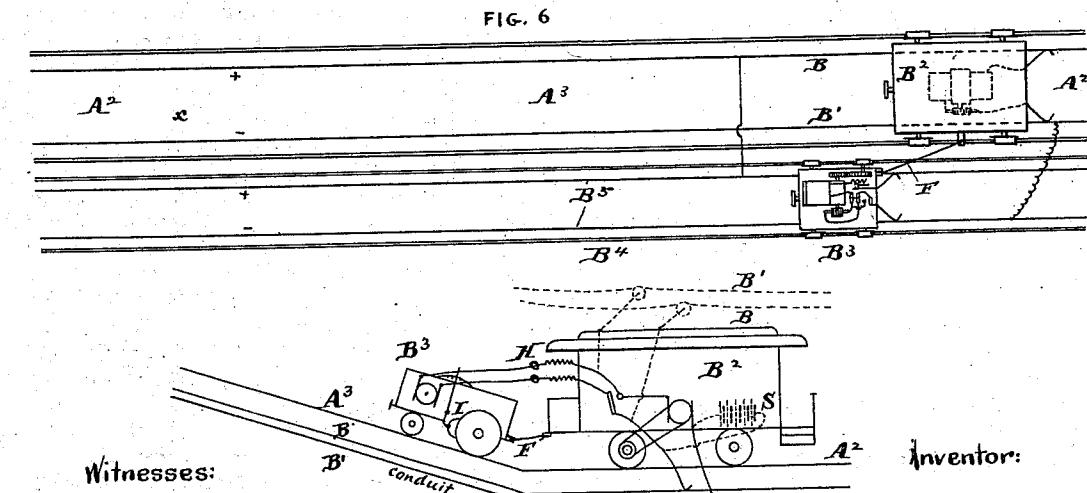
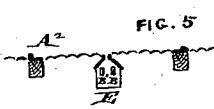
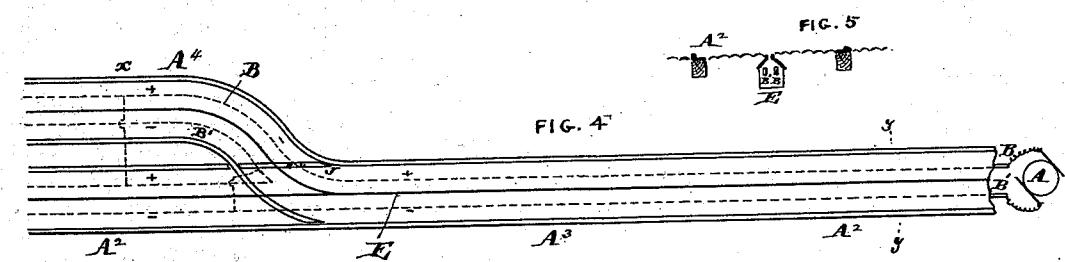
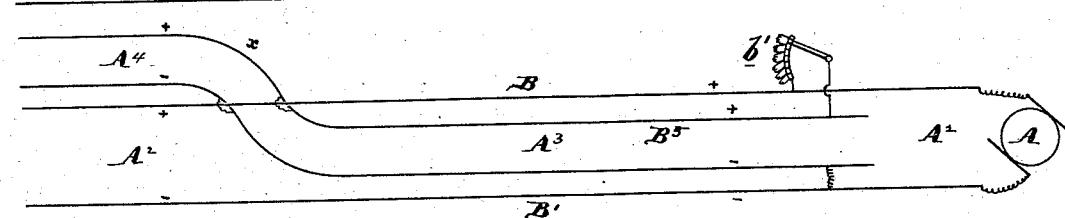
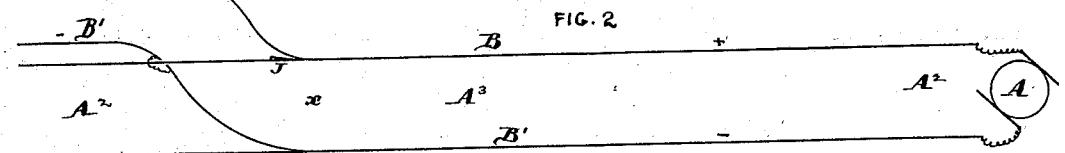
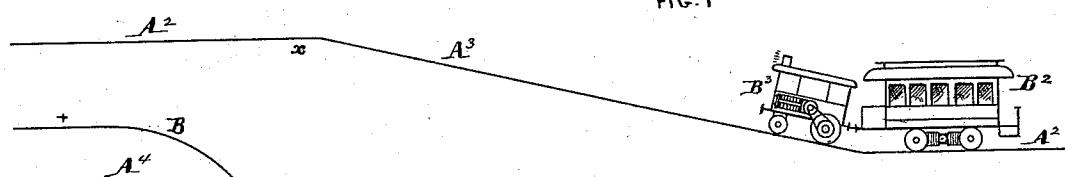


(No Model.)

R. M. HUNTER.  
INCLINE ELECTRIC RAILWAY.

No. 402,084.

Patented Apr. 23, 1889.



Witnesses:

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# UNITED STATES PATENT OFFICE.

RUDOLPH M. HUNTER, OF PHILADELPHIA, PENNSYLVANIA.

## INCLINE ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 402,084, dated April 23, 1889.

Application filed January 5, 1889. Serial No. 295,534. (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 Incline Electric Railways, (Case 78,) of which the following is a specification.

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

This application (Case 78) is for certain improvements in the construction of electric railways having steep-grade portions.

The object of my invention may be stated to be the provision of an electric railway having line-conductors with an electrically-propelled dummy or hill motor-car, whose duty it is to assist the passenger-car up the grade.

Broadly considered, my invention contemplates the employment of an electrically-propelled dummy or motor-car in a railway having a grade to assist the passenger-car (also preferably electrically propelled) up the grade, when provision is made to allow the passenger-car to pass the dummy or motor-car.

Specifically considered my invention can be carried out in several ways, the objects of which may be severally stated to be—

First. To enable in a system such as above specified a motor to be cut out of circuit without in any way interfering with the current passing down the line and without requiring any of the current to pass through the motors. It is important to have an automatic regulator independent of the motor, as in a series system any derangement of the shunt-circuits over the car or motor would affect the current in the line, and consequently all the motors in circuit would be made to feel this defect without power to overcome it. With an automatic regulator for the sections and independent of the motors such trouble would not arise, as the regulator would not be handled, and there would be no uncertain contacts for the connecting-conductors, such as would exist with a car or motor standing still.

Second. To provide an electric railway having an upgrade to be mounted with a sepa-

rate parallel track for the dummy or motor-car, so that the dummy may be coupled or uncoupled with the passenger-car to assist it up the grade or release it, respectively, and in which the dummy or motor-car never passes in the line of travel of the passenger-car. In this case both the passenger-car and dummy may be electrically propelled and receive currents from line-conductors or batteries on the car or cars.

Third. To provide a construction in which the dummy receives its electrical energy through the passenger-car, either from batteries on the latter or from line-conductors. In this case the dummy would not have any batteries nor collectors for taking current from line-conductors, but would simply have an electrical coupling for connecting its motor with the motor-conductors on the passenger-car. In coming down the grade the dummy would rely on a powerful brake to control its travel. The brake may be mechanical or electrical.

If desired, the dummy may push the car up and have the turn-out at the bottom. The employment of grade-dummies enables me to use motors on the cars of a size sufficient to propel the car fully loaded over ordinary level or slightly-inclined parts, but not up heavy grades without assistance.

My object is to avoid the necessity of large, wasteful, and cumbersome motors capable of two or three times the normal duty required of them. This cheapens the construction of plant, reduces the cost of operation, and lessens the wear upon the road-bed.

When line-conductors are employed, they may be either the rails, surface conductors independent of the rails, conductors housed in a conduit, suspended conductors, or any combinations of these. The passenger-car need not necessarily be electrically propelled.

In the drawings, Figure 1 is a side elevation of an electric railway illustrating the grade and passenger-car and dummy. Fig. 2 is a plan view of the track of same, showing the rails used as the electrical conductors. Fig. 3 is a similar view to Fig. 2, but having a separate narrow-gage track for the dummy. Fig. 4 is a plan view showing the conductors arranged similar to Fig. 2, but in which the conductors are housed in a conduit and are

separate from the track. Fig. 5 is a cross-section of Fig. 4 on line  $y-y$ . Fig. 6 is a plan view showing a modification of the dummy and passenger tracks, in which they are parallel, but never in line; and Fig. 7 is a side elevation showing a construction in which the dummy-motor receives its current from the motor-circuits of the passenger-car, and also shows the employment of overhead or underground line-conductors separate from the rails, and also a battery on the car as a source of power.

5 A is a generator or dynamo at a central station, or placed somewhere convenient, to supply electricity to the line or working conductors B B', arranged along the railway A<sup>2</sup> A<sup>3</sup>, and, if desired, forming the rails thereof.

10 A<sup>3</sup> represents an upgrade on an electric railway.

15 B<sup>3</sup> is the dummy, whose duty it is to assist the passenger-car B<sup>2</sup> up the incline and then leave it. The dummy may run upon the same rails as the car and may receive its current from the same working-conductors, or it may 20 have a separate track and separate conductors.

25 Fig. 2 shows an arrangement of tracks for the dummy and car, in which the rails may be the conductors.

30 A<sup>4</sup> is the turn-out for the dummy at the top of the grade. A switch, J, would be used to turn the dummy onto the siding A<sup>4</sup> and allow the passenger-car to travel on. This would be used where the dummy pulls the car up; 35 but when the dummy is designed to push the car up the turn-out would be at the bottom of the grade.

35 In Fig. 3 is shown separate tracks for the dummy, which may also be separate conductors receiving their current from the same source as the line-conductors, and the current supplied to these conductors may be regulated by the resistance-changer b'.

40 B<sup>5</sup> represents the dummy-tracks.

45 By the construction shown in Fig. 3 it is evident that no switch is necessary for the rails or conductors, as the passenger-car and dummy receive current from different working-conductors, although they obtain their 50 supply from the same primary source. They might, if desired, receive current from different sources.

55 In Figs. 4 and 5 we have the conductors substantially as arranged in Fig. 2, only placed in a conduit, E, and electrically connected with the car or dummy, or both, by suitable current-collectors. In this case separate track-rails are not shown, but it is evident that separate tracks may be used, as in the 60 case of Fig. 3, in which latter case the gage of the dummy might be the same, or greater or smaller, than that of the passenger-car.

65 In the various figures  $x$  indicates the top of the grade, and A<sup>3</sup> indicates the grade; but in cases where the dummy pushes the passenger-car up the grade, instead of pulling it up, the turn-out A<sup>4</sup> would be at the bottom of the

grade, which would be the same as taking the end  $x$  of Figs. 2 to 6 as being the bottom of the grade.

70 J is a switch for the rail.

In the construction shown in Fig. 6 we have two parallel tracks, the track B<sup>4</sup> being that of the dummy, and this, as in the case of Fig. 3, has separate conductors B<sup>5</sup>, which may receive current from the main-line conductors B B', being in multiple connection therewith. The dummy B<sup>3</sup> is coupled with the passenger-car by a coupling, F, which may be uncoupled at the top of the grade to allow the passenger-car to proceed on its way and the dummy to return to the bottom of the grade, to assist the next passenger-car. In this case the dummy never passes in the line of travel of the passenger-car.

75 In the construction shown in Fig. 7 we have the dummy in the position relatively to the passenger-car that it would assume in either of the cases shown in the other figures; but in this case the dummy-motor receives current from the motor circuit or conductors on the passenger-car through the flexible coupling-connection H, which may be made in any suitable manner. In this case the dummy may pull or push the passenger-car up the 80 grade, and return wholly by gravity, its speed being controlled by a suitable mechanical brake, I, or by an electric brake. When the grade is long, the motor or the dummy may be coupled so as to make it into a dynamo-electric machine or generator-brake, substantially as set out in my application, Serial No. 195,742 of 1886.

85 It is immaterial to my invention whether the motors on the dummy and passenger-car 105 be coupled in series or in multiple connection. If the dummy runs in the line of the main track, then it is necessary to run it on to a turn-out at the end of the grade, as before explained, and then uncouple the connection H.

90 In place of using conductors on the surface or in a conduit, suspended conductors may be employed, as indicated in dotted lines in Fig. 7, or such suspended conductor may be 100 used in conjunction with the other conductors, or either of them, and likewise a housed conductor may be used with a rail or ground return.

95 While line-conductors are largely employed 110 as a means of conveying current from a source to the traveling vehicle, yet I have equally well employed batteries on the car as the source of power, and have indicated in Fig. 7 in dotted lines at S such batteries as the 115 source of power. It is evident that both the passenger-car and dummy may have such batteries as the source of power.

120 The foregoing will explain the nature of my invention, and in conclusion I would say 130 that I do not limit myself to the details shown, as they may be modified in various ways without departing from the spirit of my invention.

Any matters here shown but not claimed are not dedicated to the public, but form subject-matter of other applications—to wit, Serial No. 250,278, of 1887; Serial No. 200,400, of 5 1886; Serial No. 215,200, of 1886; Serial No. 195,742, of 1886; Serial No. 208,418, of 1886; Serial No. 214,309, of 1886, and Serial No. 265,770, of 1886.

Having now described my invention, what I 10 claim as new, and desire to secure by Letters Patent, is—

1. In an electric railway having an upgrade, the combination of a source of electric supply, line working-conductors, a short switching turn-out or siding at the top of the grade provided with working-conductors for the 15 traction-dummy, and electrical connections between said working-conductors for the dummy and line-conductors or their source of 20 electrical supply.

2. In an electric railway having an upgrade, the combination of a source of electric supply, main-line working-conductors, a short switching turn-out or siding at the top of the 25 grade provided with working-conductors for the traction-dummy, electrical connections between said working-conductors for the dummy and line-conductors or their source of 30 electrical supply, and a slotted branched conduit containing said line and traction-dummy working-conductors.

3. In an electric railway having an upgrade, the combination of a source of electric supply, main-line working-conductors, a short switching turn-out or siding at the top of the 35 grade provided with working-conductors for the traction-dummy, electrical connections between said working-conductors for the dummy, and line-conductors or their source 40 of electrical supply, a slotted branched conduit containing said line and traction-dummy working-conductors, and switching devices to allow the passage of the passenger-car.

4. In an electric railway having an upgrade, the combination of a source of electric supply, main-line working-conductors, a short switching turn-out or siding at the top of the 45 grade provided with working-conductors for the traction-dummy, electrical connections between said working-conductors for the dummy and line-conductors or their source of 50 electrical supply, a slotted branched conduit containing said line and traction-dummy

55 working-conductors, switching devices to switch the dummy onto the siding or turn-out to allow the passage of the passenger-car, an electrically-propelled passenger-car, a traction dummy or motor to assist said car up the 60 grade, and a disconnectible coupling between said car and traction-dummy.

5. The combination of an electric railway 65 arranged on an incline with a substantially-horizontal part at top and bottom, a dummy-track at one end of said inclined portion of the railway arranged out of line of the main track to support the dummy to one side of the

main track, electrical conductors for the dummy on the inclined portion of the railway, an electrically-propelled dummy or traction-vehicle, a passenger-car to run upon the main track, and a coupling between the passenger-car and dummy, whereby the dummy may assist the passenger-car up the grade or incline, and also allow the passenger-car to 75 pass the dummy.

6. The combination of a railway-track having a grade portion, a main-line conductor arranged along the railway, an electrically-propelled passenger-car receiving current from 80 said conductor, a dummy-track, a conductor for said dummy-track, an electrically-propelled dummy for assisting the passenger-car up the grade receiving current from said conductor for the dummy-track, and a detachable coupling between the dummy and passenger-car.

7. The combination of a railway-track having a grade portion, a main-line conductor arranged along the railway, an electrically-propelled passenger-car receiving current from 90 said conductor, a dummy-track, a conductor for said dummy-track, an electrically-propelled dummy for assisting the passenger-car up the grade receiving current from said conductor for the dummy-track, a common source 95 of supply to the main-line and dummy-track conductors, and a detachable coupling between the dummy and passenger-car.

8. The combination of a railway-track having a grade portion, a main-line conductor arranged along the railway, an electrically-propelled passenger-car receiving current from 100 said conductor, a dummy-track, a conductor for said dummy-track, an electrically-propelled dummy for assisting the passenger-car up the grade receiving current from said conductor for the dummy-track, a common source 105 of supply to the main-line and dummy-track conductors, a regulator to regulate the current supplied to the dummy-track conductor, and a detachable coupling between the dummy 110 and passenger-car.

9. The combination, in a railway, of a main track having a grade, an auxiliary track at 115 the grade, a passenger-car adapted to run on the main track, an electrically-propelled dummy-car to run upon the auxiliary track, a coupling between the passenger-car and dummy, and a source of electric supply to the motor 120 on the dummy.

10. The combination, in a railway, of a main track having a grade, an auxiliary track at the grade, an electrically-propelled passenger-car adapted to run on the main track, an electrically-propelled dummy-car to run upon the auxiliary track, a coupling between the passenger-car and dummy, and a source of 125 electric supply to the motor on the dummy and passenger-car.

11. The combination, in a railway, of a main track having a grade, an auxiliary track at the grade, a passenger-car adapted to run on the main track, an electrically-propelled dum- 130

my-car to run upon the auxiliary track, a coupling between the passenger-car and dummy, separate conductors for the main track and auxiliary track, and electrical connections between the motors on the passenger-car and dummy.

12. The combination, in a railway, of a main track having a grade, an auxiliary track at the grade, a passenger-car adapted to run on the main track, an electrically-propelled dummy-car to run upon the auxiliary track, a coupling between the passenger-car and dummy, separate conductors for the main track and auxiliary track, electrical connections between the motors on the passenger-car and dummy, and a common source of electric energy for both conductors.

13. The combination, in an electric railway having a grade, of the main track and line-conductor, with an auxiliary parallel track at the grade portion, an electrically-propelled passenger-car for the main track, a traction electrically-propelled dummy for the auxiliary track, a common source of electric energy, and a detachable coupling between the passenger-car and dummy.

14. The combination, in an electric railway having a grade, of the main track and line-conductor, with an auxiliary parallel track at the grade portion, an electrically-propelled passenger-car for the main track, a traction electrically-propelled dummy for the auxiliary track, a common source of electric energy, and a detachable coupling between the passenger-car and dummy.

15. The combination, in an electric railway having a grade, of the main track and line-conductor, with an auxiliary parallel track at the grade portion, an electrically-propelled passenger-car for the main track, a traction electrically-propelled dummy for the auxiliary track, and a conductor for the auxiliary track, and electrical connection between the conductors for the respective tracks and the car and dummy.

16. The combination, in an electric railway having a grade, of the main track with a dummy turn-out track at one end of the grade, an electrically-propelled passenger-car, an electrically-propelled dummy for assisting the car up the grade, a detachable coupling between the car and dummy, and a common source of electric energy for the motors of both the passenger-car and dummy.

17. The combination of a main track having a line-conductor, a parallel auxiliary track having a longitudinal conductor, a source of electric supply for said conductors, and a regulator to control the current passing to the conductor of the auxiliary track.

18. The combination of two electrically-propelled vehicles coupled together, a common source of electric energy for the motors of both vehicles, and a regulator independent of the two vehicles to control the relative supply of electricity to the motors.

19. The combination of a main track and line-conductor, a source of electric energy, an auxiliary track and conductor at a distance from the source of supply, and a connection between the two track-conductors, whereby the auxiliary track-conductor receives current from the source of supply through the line-conductor of the main track.

20. In an electric railway, line working-conductors from which a traveling motor derives its current, having an upgrade, in combination with a short section of working-conductors having a length substantially equal to said grade and arranged parallel to said line-conductors and on the grade, a passenger electrically-propelled vehicle receiving current from the line-conductors, a traction-motor or dummy receiving current from the short-grade sections of working-conductors, and a disconnectible coupling between the passenger-vehicle and dummy.

21. In an electric railway, line working-conductors from which a traveling motor derives its current, having an upgrade, in combination with a short section of working-conductors having a length substantially equal to said grade, and arranged parallel to said line-conductors and on the grade, and a common source of electric supply for both the line-conductors and upgrade-motor conductors.

22. In an electric railway, a line of working-conductors from which a traveling motor derives its current, having an upgrade, in combination with a short section of working-conductors having a length substantially equal to said grade, and arranged parallel to said line-conductors on the grade, an electric generator to supply electricity to said line-conductors, and branch conductors connecting the line-conductors with the corresponding conductors of the upgrade-motor circuit.

23. In an electric railway, a line of working-conductors from which a traveling motor derives its current, having an upgrade, in combination with a short section of working-conductors having a length substantially equal to said grade, arranged parallel to said line-conductors and on the grade, and an electrically-propelled passenger-vehicle receiving electricity from the line-conductors, an electric motor receiving electricity from the upgrade-motor conductors, and a disconnectible coupling between the motor and passenger-vehicle.

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

RUDOLPH M. HUNTER.

Witnesses:

ERNEST HOWARD HUNTER,  
E. M. BRECKINREED.