No. 732,157. PATENTED JUNE 30, 1903.

A. H. BEDWORTH.

ELECTRIC RAILWAY.

APPLICATION FILED NOV. 13, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

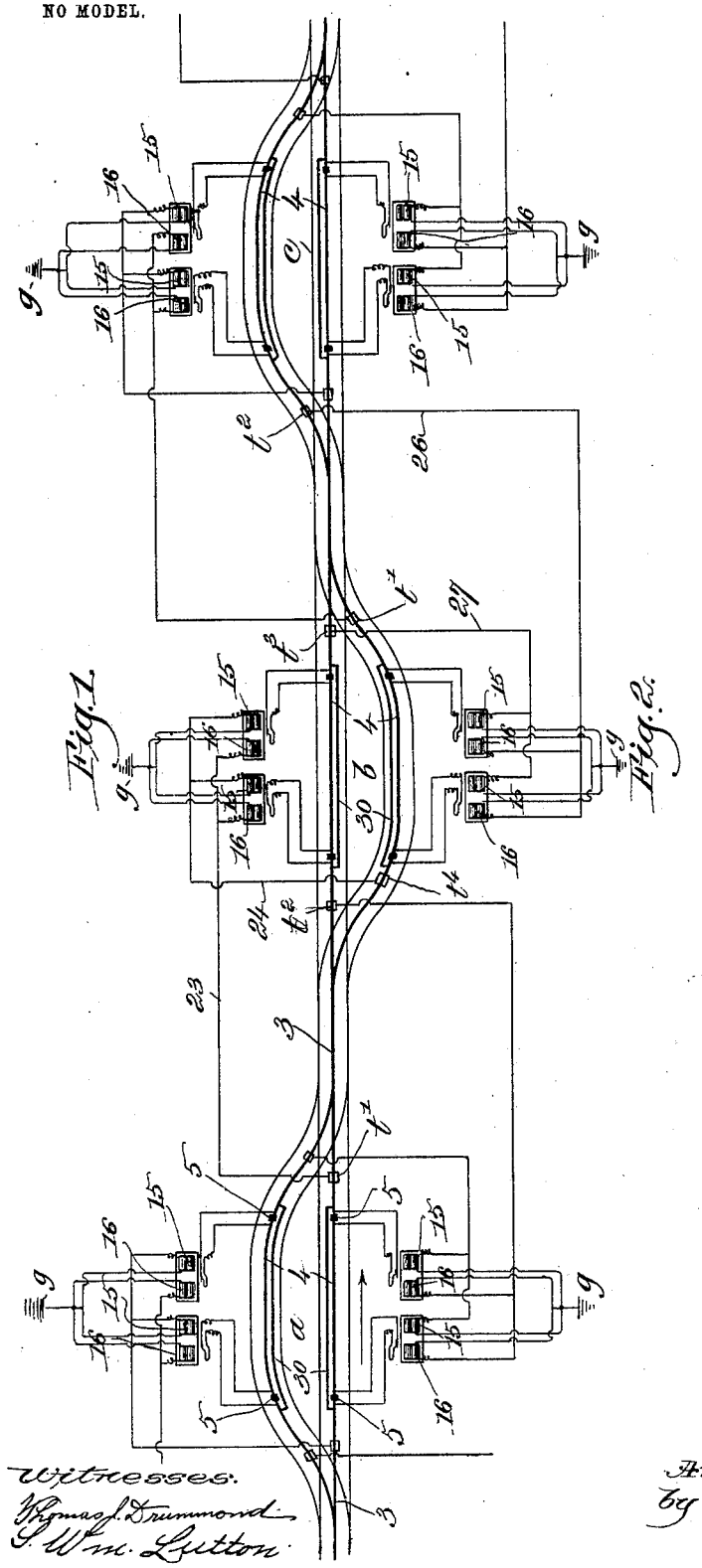


Fig. 1.

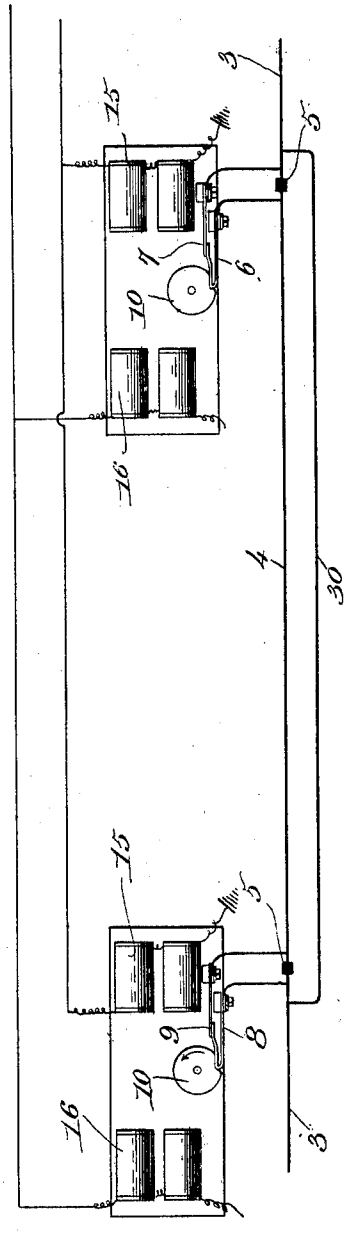


Fig. 2.

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P. Wm. Lytton.

Inventor.
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NO MODEL. 3 SHEETS—SHEET 2.

Fig. 3.

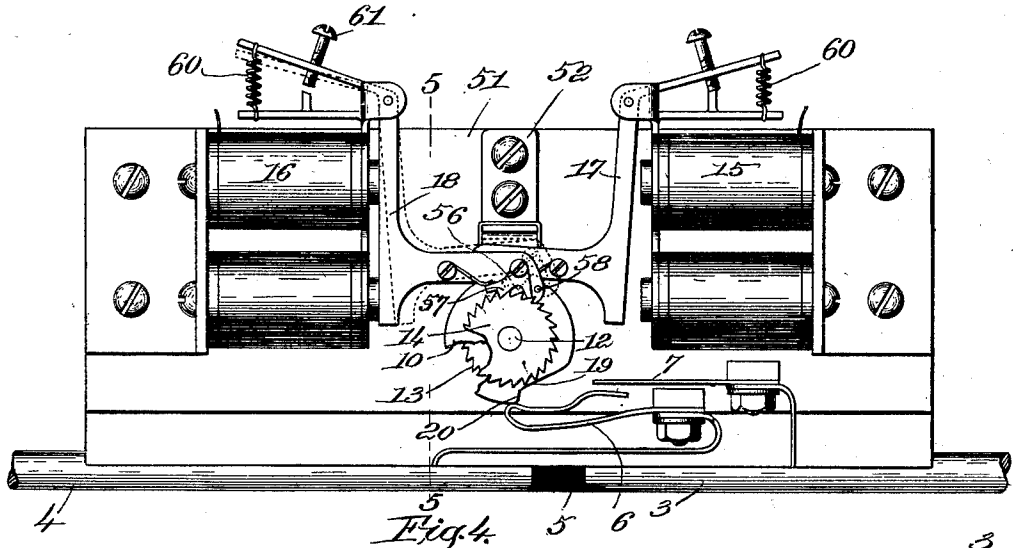


Fig. 4.

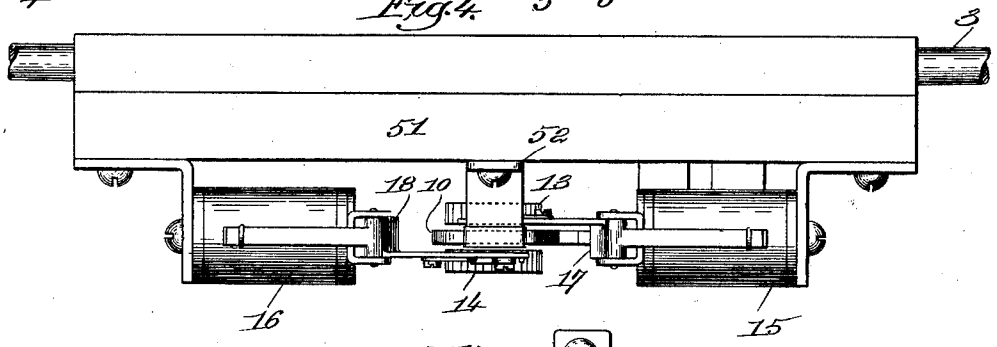


Fig. 5.

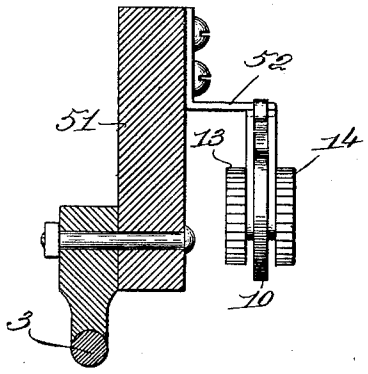


Fig. 9.

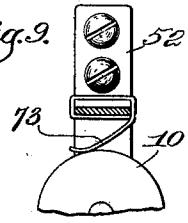
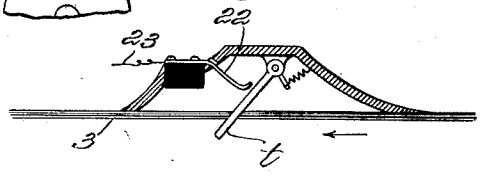


Fig. 6.



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No. 732,157. PATENTED JUNE 30, 1903.

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APPLICATION FILED NOV. 13, 1902.

NO MODEL. 3 SHEETS—SHEET 3.

Fig. 7.

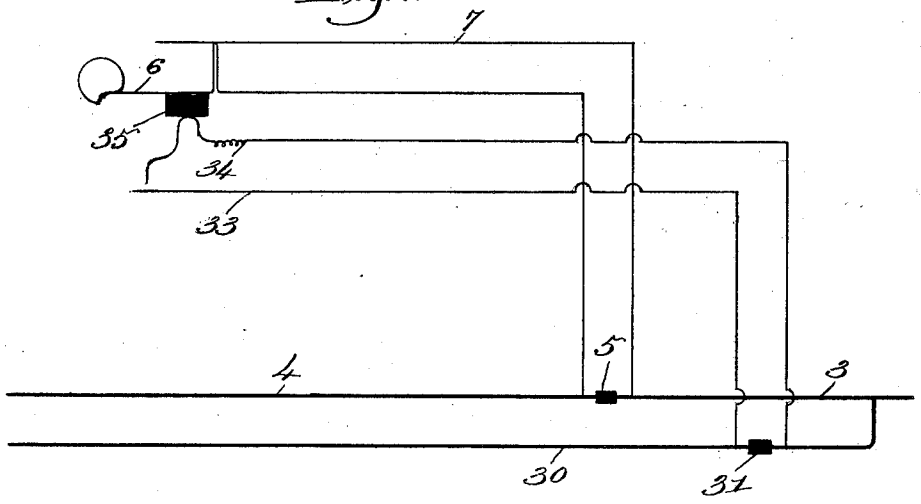
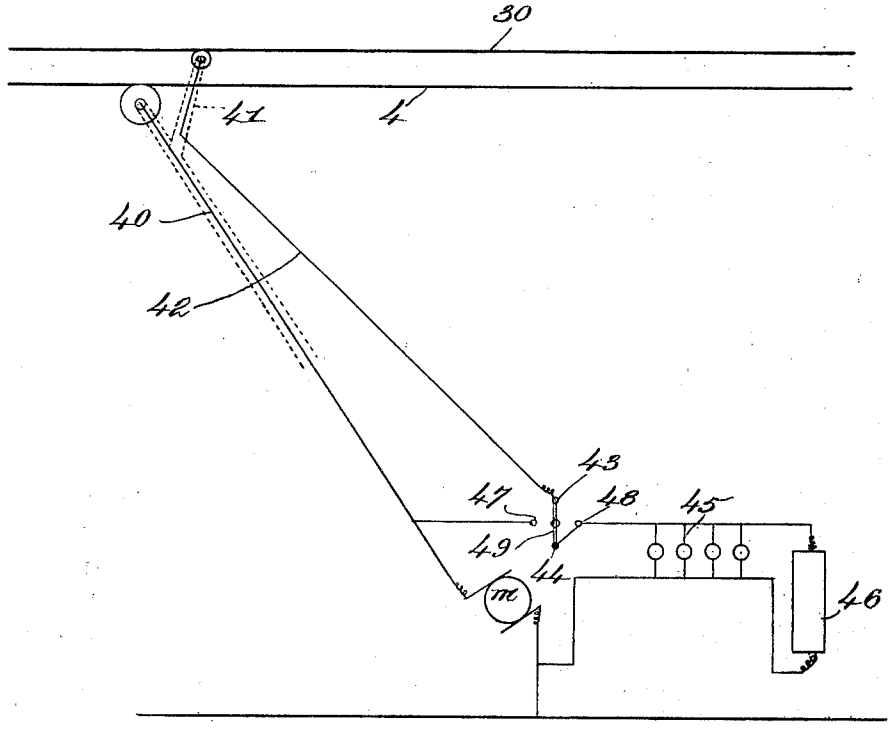


Fig. 8.



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UNITED STATES PATENT OFFICE.

ARTHUR H. BEDWORTH, OF BOSTON, MASSACHUSETTS, ASSIGNOR OF TWO-THIRDS TO F. S. WEBSTER COMPANY, OF BOSTON, MASSACHUSETTS; NEW YORK, N. Y.; CHICAGO, ILLINOIS, AND LONDON, ENGLAND, A CORPORATION OF MAINE, AND JOHN A. BEDWORTH, OF BOSTON, MASSACHUSETTS.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 732,157, dated June 30, 1903.

Application filed November 13, 1902. Serial No. 131,103. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR H. BEDWORTH, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Electric Railways, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

Electric railways, especially single-track railways, are frequently provided with an automatic block-signaling system, whereby when any car enters a block a signal is automatically displayed at the other end of the block to warn a car coming in the opposite direction that the block is occupied. It frequently happens, however, that a car will run by a signal either because the motorman failed to see the signal or because he neglects to heed the same, and when such an occurrence happens the danger of collision is imminent.

It is the object of my invention to provide means whereby it will be impossible for a car to enter a block if the block is occupied by a car moving in the opposite direction, and this I accomplish by providing means, as hereinafter described, whereby when a car enters a block the power will be shut off from a section of track at the opposite end of the block, so that a car moving in the opposite direction upon running into the said insulated or "dead" section of the track will be brought to a standstill because of its inability to receive any power. My mechanism also is so constructed that when the first-named car passes out of the block and the block is clear the power is restored to the stalled car or to the insulated section of track, thus permitting the said car to resume its journey. With my invention, therefore, the stopping of a car moving in one direction and before entering a block which is occupied by a car moving in the opposite direction is a matter outside of the control of the motorman, and the danger due to collisions is entirely avoided.

The invention will be best explained in connection with the accompanying drawings, in which—

Figure 1 is a diagrammatic view of a portion of an electric railway, showing the arrangement of my improved device. Fig. 2 is an enlarged diagrammatic view of the device situated at each insulated section of the trolley-wire. Fig. 3 is a side elevation of one of the step-by-step devices employed for throwing the insulated sections of trolley-wire into or out from the circuit. Fig. 4 is a top plan view of Fig. 3. Fig. 5 is a section on the line $x x$, Fig. 3, the pawls and contacts being omitted. Fig. 6 is a detail of the trip I prefer to use. Fig. 7 is a modification hereinafter referred to. Figs. 8 and 9 are details to be more fully hereinafter described.

My invention is especially applicable to a single-track railway, and in Fig. 1 I have shown a section of said railway having at appropriate distances suitable turnouts for the passing of cars, these turnouts being designated by a, b, and c, respectively. The stretch of track between adjacent turnouts I have termed a "block." Preferably the switches at the various turnouts will be so arranged that in moving in either direction a car will be directed automatically to the right, as usual in electric-railway construction.

The trolley-wire is designated by 3, and it of course is provided with turnouts corresponding to the turnouts in the track. Each branch of the trolley-wire at each turnout is provided with an insulated section 4, which is normally connected with the main portion of the trolley-wire, the said sections being insulated in any suitable way, as by blocks of insulating material 5.

My invention comprises devices whereby when a car passes over one branch of one turnout and is thus about to enter a block the insulated section in the opposite branch of the next turnout will be rendered "dead," whereby a car moving in the opposite direction will be stalled on said branch of the track until the first-named car has passed out of the block. The means I have herein chosen to accomplish this end comprises a switch or a pair of normally closed contacts at each end of the insulated section and

means operable from the end of a block at which a car enters to open the two pairs of contacts at one of the insulated sections at the turnout at the opposite end of the block. One form of such contacts or switches is illustrated in Fig. 2, wherein 6 7 and 8 9 represent two pairs of contacts, one at each end of the insulated section 4, the contacts 7 8 of the two pairs being connected with the main portion 3 of the trolley-wire, and the contacts 6 9 being connected to the insulated portion 4. When the contacts are closed, as shown in Fig. 2, the insulated section 4 is in circuit with the main portion 3 of the trolley-wire, and the current in traversing the trolley-wire passes through the contacts and through the insulated section, which is thus rendered "alive." This arrangement exists at each of the insulated sections. At the appropriate times the contacts at any insulated section 4 are opened by some suitable means, thus insulating the said section, the means herein represented being cams 10, one for each of the pairs of contacts which are adapted to engage the movable contacts of the pairs of contacts. Each cam is rendered operative automatically by the passing of a car over one of the branches of the next adjacent turnout, and one way of accomplishing this will now be described. Since the cam-operating mechanism for each cam is the same, it will suffice to describe that for a single cam only. Each cam is shown as being carried on a shaft 12, on which are the oppositely-disposed ratchets 13 and 14. The ratchets are operated by magnets 15 and 16, respectively, for which purpose the armatures 17 and 18 of said magnets are provided with suitable pawl mechanism so arranged that when the magnets are energized the ratchets are turned. As herein shown, the magnet 16 is the one which operates to open the contacts, while the magnet 15 is the one which operates to close the contacts. The cam is so arranged that normally the end of the contact lies in the low portion 19 thereof; but when the magnet 16 is energized the cam is rotated one step, and the rise 20 thereon by its engagement with the contact 6 forces the same away from the contact 7.

A pawl-and-ratchet mechanism such as above described is employed for each pair of contacts, and there are therefore two such mechanisms for each insulated section of trolley-wire, one at each end thereof.

The various magnets 15 16 are in circuits hereinafter described, which include some suitable trip devices capable of being operated by the trolley, one form of which is illustrated in Fig. 6. In said figure the trip t, which is adapted to be engaged by the trolley-wheel, is electrically connected with the trolley-wire, and when moved in the direction of the arrow by the trolley-wheel it closes against a contact 22, which is insulated from the trolley-wire and which connects with a wire 23, leading to the appropriate magnet. When the contacts t and 22 are closed, current from the main conductor or trolley-wire 3 will pass through the magnet, which is connected to the ground or return wire, and the magnet will be momentarily energized.

The operation of my mechanism as above described is as follows: Assuming a car to be moving in the direction of the arrow, Fig. 1—that is, from left to right—when it is about to pass out of the lower branch of the turnout at a it engages a trip similar in all respects to that shown in Fig. 6 and designated by t', thereby momentarily closing the circuit 23 and energizing the magnets 16 at each end of the insulated section 4 on the opposite branch of turnout b, whereby the contacts at each end of said insulated section are opened and the section rendered dead. If now a car moving in the opposite direction runs into the turnout b, it will be stalled or held in said turnout because of its inability to get power to proceed so long as the car first mentioned is occupying the block between the turnouts a and b. When said first-mentioned car leaves the block and enters the lower branch or turnout b, it engages a trip device t^4 similar to that shown in Fig. 6, which closes the circuit through wire 24 and magnets 15 to the ground g, thus energizing said magnets 15 and again allowing the contacts at each end of the dead section at the turnout b to close. When this occurs, the car which has been stalled can receive power and proceed on its way, while the first-mentioned car passes through the turnout b, and as it leaves the latter engages a second trip t', which in the manner already described renders dead the insulated section 4 in the opposite branch of turnout c. Cars moving in the opposite direction, or from right to left, operate in a similar manner to render dead or alive the insulated sections in the opposite branches of the next preceding turnout. For instance, if a car is moving toward the left and moving out of the turnout c it engages a trip t^2, which momentarily closes the circuit 26, including the magnets 16, at the insulated section 4 on the opposite branch of the turnout b, and thus renders said insulated section dead. As the said car emerges from the said block between b and c and passes into the turnout b it operates a trip t^3, which momentarily closes the circuit 27, including the magnets 15, at the opposite branch of said turnout, thus restoring the current to the said insulated section. This operation is repeated at each block.

In this invention the trolley-wire 3 constitutes the main conductor, and in order not to break the main circuit when any one insulated section of track is rendered dead I will preferably provide at each insulated section a shunt-circuit 30, which extends around the insulated section and through which the current passes when the insulated section is dead. This maintains the continuity of the

circuit, so that cars at different points of the line are not affected by the insulating of any one insulated section. In the form of my invention shown in Fig. 2 the shunt-circuit 30 is always closed, and as a consequence when the insulated section 4 is alive the current would split between the two circuits 4 and 30. If desired, I may provide the shunt-circuit 30 with contacts which are automatically opened when the contacts 6 7 and 8 9 are closed, and vice versa. In such event whenever any insulated section 4 is dead the current is shunted around said section through the wire 30; but when the section 4 is alive the shunt-section 30 is broken. The full current therefore either passes through the trolley-wire section 4 or the shunt-circuit 30. Fig. 7 illustrates how this may be accomplished. 31 indicates a piece of insulating material in the wire 30, and the said wire on each side of said insulating material is connected to normally open contacts 33 34. The contact 34 may be operated by the contact 6, and I have herein shown the latter contact as having a block of insulating material 35, which bears against the contact 34. With the parts in the position shown in Fig. 1 the contacts 6 7 are closed and 33 34 are opened, which is the normal condition, and the current will all pass through the section 4. When, however, the magnet 16 is energized, the contacts 6 7 are opened, as above described, and the contact 6 by its engagement with the contact 34 closes the latter against 33, and thereby closes the shunt-circuit. Any other suitable means for shunting the current from the section 4 to the circuit 30 may be employed, however, without departing from the spirit of my invention.

It will be noted that the contact-operating mechanism I employ is a step-by-step device, so that each time that the trip t' is operated the cam 10 will be advanced one step. If, therefore, four or any other number of cars follow one another into any block, the cam controlling the contacts at the insulated section at the turnout at the end of the block will be advanced a number of steps equal to the number of cars which have passed into the block. Obviously the contacts cannot be closed to thus render alive again the insulated section 4 until the cam has been moved backwardly the same number of steps that it was moved forwardly, and this will not be accomplished until the trip t^4 has been operated a number of times equal to the number of cars which passed into the block. My invention, therefore, is one in which the insulated section of trolley-wire remains dead so long as any car is in the block and is only rendered alive when all the cars, however many, have passed out of the block. This I consider as quite important.

As electric cars are now commonly built the lights and the heating apparatus are operated by current taken from the trolley-wire. It will be apparent that when such a car is stalled on a dead portion of track the lights in the car will go out and the heating apparatus will receive no current. To enable the lights to be maintained and the heating device to be operated while the car is stalled, I will preferably employ suitable mechanism whereby the lights and heating apparatus may be operated from current taken from the shunt-circuit 30, whereby when a car is stalled the motor cannot be operated, but the lights and heating apparatus are not rendered inoperative. Any suitable means may be employed to accomplish this, and I have herein shown the trolley-arm 40 as having a supplemental arm 41, carrying a trolley-wheel adapted to contact with the shunt-wire 30, which in practice will be situated comparatively close to the insulated portion 4. A separate conductor 42 extends from the supplemental arm 41 to the switch-point 43 of a four-point switch, the point 44 being connected to the heating apparatus 46 and the lights 45. Of the other points 47 and 48 of the switch one connects directly to the motor m and the other to the heating apparatus and lights. Normally the switch-plate 49 will connect the points 47 48; but when the car runs onto an insulated section of track and the lights go out the motorman or conductor will throw the switch-plate to connect points 43 44, whereby current from the shunt-circuit 30 may be taken through the heating apparatus and used for lighting purposes. The motor, however, being in circuit with the insulated section of trolley-wire can receive no power until such insulated section is rendered alive.

The step-by-step device and the magnets may be supported in any suitable position either directly on the trolley-wire itself or on a suitable support at the side of the track. I have herein shown them as carried by the trolley-wire. For this purpose the magnets will be suitably supported upon a block 51, of insulating material, which will in turn be carried by the trolley-wire 3, and the contacts 6 and 7 will be suitably secured to said block 51. When this construction is employed, it will be understood that suitable guy-wires are used to hold the block 51 in an upright position.

The shaft 12, carrying the step-by-step device, is shown as being supported in a suitable bracket 52, and while any suitable pawl mechanism may be employed I prefer to employ one which will prevent the ratchet from overrunning, thus insuring an absolute step-by-step movement. As herein shown, each armature has pivoted thereto a pawl 56, having a nose 57 to engage the teeth of the ratchet and also a tail 58, which is adapted to be brought into engagement with the back side of a ratchet-tooth to thus prevent the ratchet from overrunning. Suitable springs 60 operate to restore the armatures, and consequently the pawls, to their normal position, and, if desired, I may employ suitable stops 61 for limiting the outward movement of the

armatures. It is sometimes desirable to provide a brake device to prevent the cam, and consequently the ratchets, from being pulled backwardly with the pawl when the latter is withdrawn, and hence I have illustrated a friction-brake 73 for this purpose. These details of construction of the pawl-and-ratchet mechanism are, however, such as come within the province of the mechanic and do not form a vital part of my invention, and they may therefore be varied in various ways without departing from my invention as set forth in the appended claims.

While I have herein shown an automatic mechanism for accomplishing the result aimed at, my invention is not limited to automatic devices and, if desired, I may make the system a manually-operated one. In this case the trips t' would be placed in some convenient position for the motorman or conductor to operate, and reliance would have to be placed upon the latter to properly manipulate the trips upon entering or leaving a block. I prefer, however, to employ the automatic system for obvious reasons.

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

1. An electric railway divided into blocks, and means whereby the passing of a car into a block insulates a section of the trolley-wire at the other end of the block, said means operating to maintain the said section insulated until said car and any following car or cars have passed out of the block.

2. An electric railway divided into blocks, and means whereby the passing of a car into a block from either direction insulates a section of the trolley-wire at the opposite end of the block, said means operating to maintain the said section insulated until said car and any following car or cars have passed out of the block.

3. An electric railway divided into blocks, and means whereby the passing of a car into a block insulates a portion of the trolley-wire at the other end of the block, said means including a step-by-step device whereby if a plurality of cars follow each other into the block the said section will remain insulated until all of the cars have passed out of the block.

4. In an electric railway, a trolley-wire provided with turnouts and having an insulated section in each branch of each turnout, said trolley-wire constituting a main conductor, and means whereby the moving of a trolley or equivalent device over a branch of one turnout will render dead the insulated section in one of the branches of the next turnout.

5. In an electric railway, a trolley-wire provided with turnouts and having an insulated section in each branch of each turnout, said trolley-wire constituting a main conductor, means whereby the moving of a trolley or equivalent device over a branch of one turnout will render dead the insulated section in one of the branches of the next turnout, and means whereby the moving of said trolley or other device over the other branch of said last-named turnout will render alive again the dead section at said turnout.

6. An electric railway divided into blocks and having a trolley-wire provided with an insulated section at one end of each block, normally closed contacts electrically connecting each end of each insulated section to the main portion of the trolley-wire, and means operated by a car entering a block to open the contacts at each end of the insulated section at the opposite end of the block.

7. An electric railway divided into blocks and having a trolley-wire provided with an insulated section at each end of each block, normally closed contacts electrically connecting each end of each insulated section to the main portion of the trolley-wire, and means operated by a car entering a block from either direction to open the contacts at the opposite end of the block.

8. An electric railway divided into blocks and having a trolley-wire provided with an insulated section at one end of each block, normally closed contacts electrically connecting each end of each insulated section to the main portion of the trolley-wire, means operated by a car entering a block to open the contacts at each end of the insulated section at the opposite end of the block, and means operated by a car leaving said block to close said contacts.

9. An electric railway divided into blocks and having a trolley-wire provided with an insulated section at each end of each block, normally closed contacts electrically connecting each end of each insulated section to the main portion of the trolley-wire, means operated by a car entering the block from either direction to open the contacts at the opposite end of the block, and means operated by the car leaving said block to close said contacts.

10. An electric railway divided into blocks and having a trolley-wire provided with an insulated section at one end of each block, normally closed contacts electrically connecting each end of each insulated section to the main portion of the trolley-wire, and automatic means to open or close simultaneously the contacts at each end of any insulated section, said means including step-by-step devices.

11. An electric railway divided into blocks, and means operable from one end of the block to insulate a section of the trolley-wire at the other end of the block, such means including a step-by-step device whereby if a plurality of cars follow each other into the block the said section of trolley-wire will remain insulated until all the cars have passed out of the block.

12. An electric railway divided into blocks and having a trolley-wire provided with an insulated section at one end of each block, normally closed contacts electrically connecting

each end of each insulated section to the main portion of the trolley-wire and means operable from one end of the block to open the contacts at each end of the insulated section at the opposite end of the block.

13. In an electric railway, a trolley-wire provided with an insulated section, means including a car-operated trip to render said section dead as a car approaches said section, said means operating to maintain the section dead so long as said car or any following it remains on the stretch between the trip and the insulated section.

14. A system comprising a single-track electric railway divided into blocks by turnouts, and automatic mechanism controlled by a car approaching any turnout from one direction for cutting the supply of current from a car coming from the opposite direction when the latter reaches said turnout, said mechanism operating to prevent the supply of current from being restored to the latter car so long as the former car or any which may follow it into the block remains on said block.

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

ARTHUR H. BEDWORTH.

Witnesses:
LOUIS C. SMITH,
JOHN C. EDWARDS.