(No Model.) 3 Sheets—Sheet 1.

R. V. CHEATHAM.

AUTOMATIC ELECTRIC SWITCH FOR RAILWAYS.

No. 550 868. Patented Dec. 3, 1895.

Fig. 1.

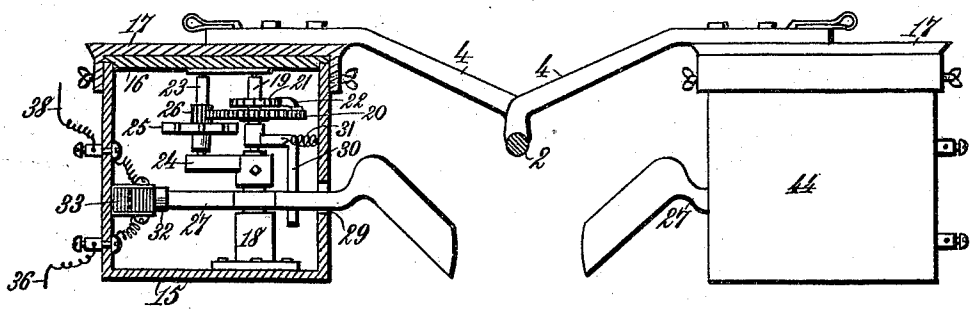


Fig. 2.

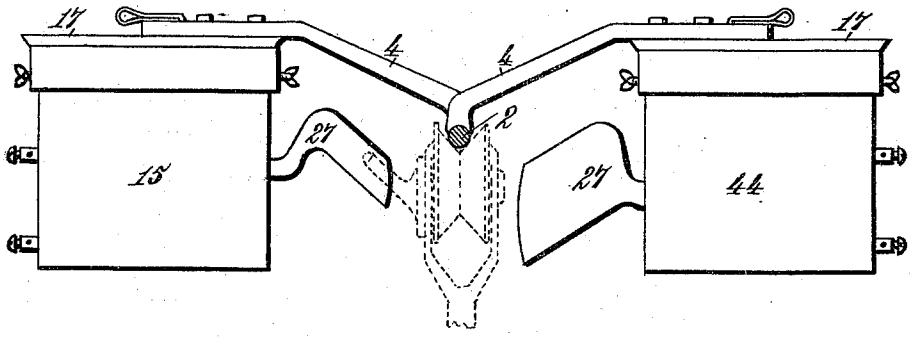


Fig. 3.

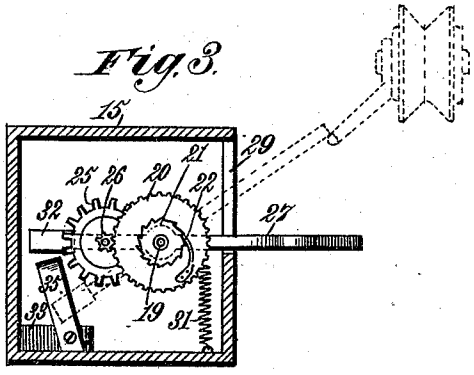
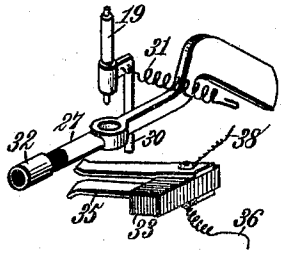


Fig. 4.



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Dennis Dumby.

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By James L. Norris.
Atty.

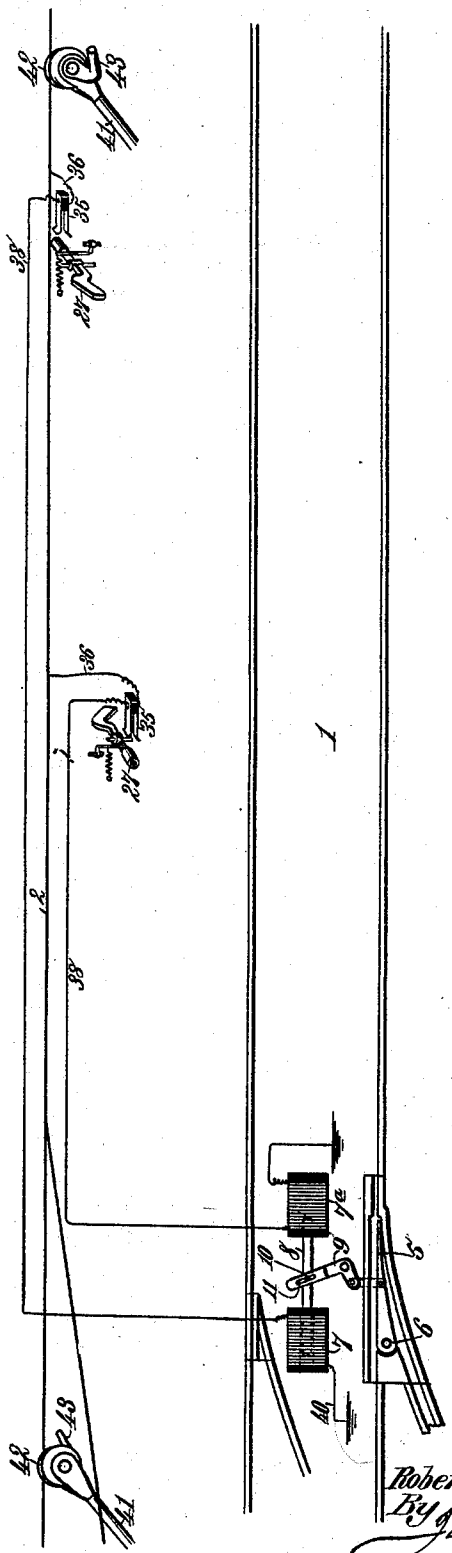
(No Model.) 3 Sheets—Sheet 2.

R. V. CHEATHAM.

AUTOMATIC ELECTRIC SWITCH FOR RAILWAYS.

No. 550,868. Patented Dec. 3, 1895.

Fig. 2.



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(No Model.) 3 Sheets—Sheet 3.

R. V. CHEATHAM.

AUTOMATIC ELECTRIC SWITCH FOR RAILWAYS.

No. 550,868. Patented Dec. 3, 1895.

Fig. 6.

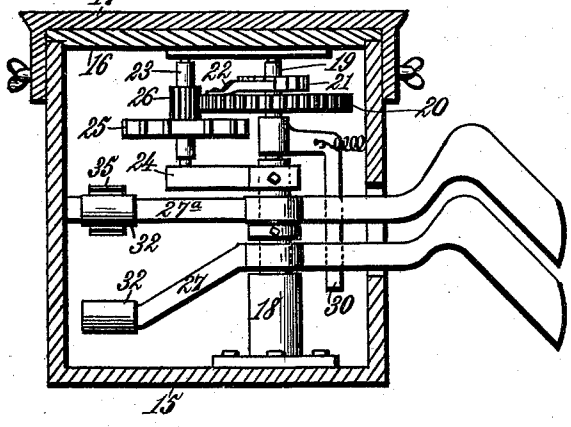


Fig. 7.

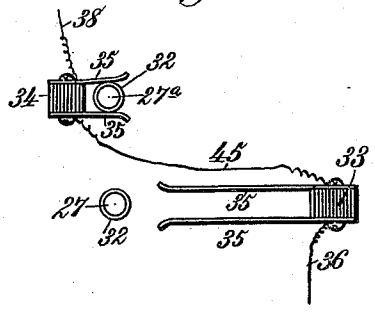


Fig. 8.

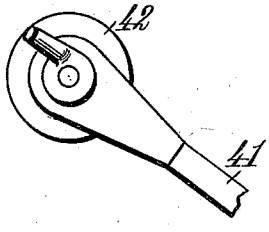


Fig. 9.

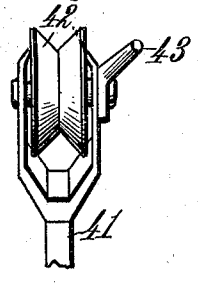


Fig. 10.

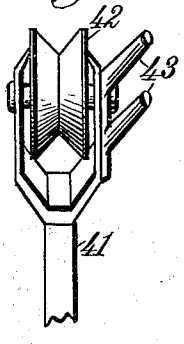


Fig. 11.

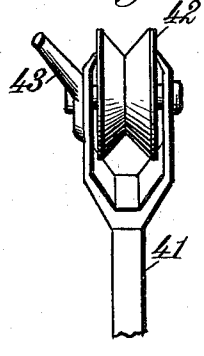
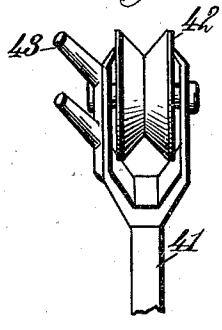


Fig. 12.



Witnesses.
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Dennis Sumby.

Inventor:
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By James L. Norris.
Atty.

UNITED STATES PATENT OFFICE.

ROBERT V. CHEATHAM, OF LOUISVILLE, KENTUCKY.

AUTOMATIC ELECTRIC SWITCH FOR RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 550,868, dated December 3, 1895.

Application filed March 7, 1895. Serial No. 540,841. (No model.)

To all whom it may concern:

Be it known that I, ROBERT V. CHEATHAM, a citizen of the United States, residing at Louisville, in the county of Jefferson and State of Kentucky, have invented new and useful Improvements in Automatic Electric Switches for Railways, of which the following is a specification.

My invention relates to automatic electric switches for railways, my purpose being to provide a simple construction and arrangement of parts by which each of a series of switches may be operated by the trolley of the individual car which is to be transferred to a branch track, the switch-rail or point-rail being moved by an electrically-operated device controlled in its action by an attachment to the trolley having such form that it may be arranged in accordance with a predetermined series of combinations differing in number or in position, or in both respects, whereby the moving trolley on each car will operatively engage one of the switch-operating mechanisms and set the switch at a suitable distance in advance of the car, provision being made for automatically returning the switch-rail and switch-operating devices to their original position.

It is a further purpose of my invention to provide a switch for electrically-operated railways, in which the point-rail shall be operated by electric devices which derive their energy from the current carried by the trolley-wires.

The invention consists to these ends in the novel parts and combinations of parts hereinafter fully set forth, and then definitely pointed out in the claims which conclude this specification.

To enable those skilled in the art to fully understand and to construct and use my said invention, I will now proceed to describe the same in detail, reference being had for this purpose to the accompanying drawings, in which—

Figure 1 is a view partly in elevation and partly in vertical section, showing two current-boxes on the trolley-wire support. Fig. 2 is a similar view in elevation, showing the trolley-staff and illustrating a modified construction of one of the levers in the current-box. Fig. 3 is a horizontal section of one of the current-boxes, showing the trolley and the manner of operating the lever. Fig. 4 is a detail perspective of the lever, contact-strips, and returning or restoring devices removed from the box. Fig. 5 is a diagram showing the arrangement of the track and siding and the trolley-wire circuit and current-boxes for operating a single switch. Fig. 6 is a vertical section showing a duplex current-box. Fig. 7 is a diagram showing the relative position of the levers and their respective contact-strips in the box shown in Fig. 6. Fig. 8 is a side elevation of the fork of the trolley-staff, showing a spur for operating the lever of a current-box. Fig. 9 is a rear elevation of the trolley shown in Fig. 8. Figs. 10, 11, and 12 are detail views showing the manner of differentiating the lever-operating devices.

The reference-numeral 1 in said drawings indicates the roadway of any ordinary line of cars in which electric energy is used as the means of propulsion. The numeral 2 denotes the electrical main from which current is supplied to the motors on the cars, the support therefor being upon poles, which sustain overhead brackets 4. The construction and arrangement of these parts may be of any preferred kind.

The several switches along the line of road, by which cars are transferred either to or from a side track or branch road, are denoted by the reference-numeral 5, which indicates more particularly the point-rail or movable switch-rail. This is provided with a pivotal axis 6, arranged between the diverging rails, the switch-rail being preferably of approximately triangular form, as shown in Fig. 5. The position of the switch-rail is controlled by two solenoids 7 and 7ª, to the core-bar 8 of which a bell-crank lever 9 is connected by means of a stud or pin 10, which engages a slot 12 in one arm of said lever. The other arm is linked pivotally to the switch-rail. By throwing the core-bar 8 in opposite directions, said bar being substantially parallel with the track, the bell-crank lever will be operated and the switch-rail will be moved to its opposite positions alternately. The means by which this movement is produced and timed are as follows.

Upon the bracket 4, which also forms the

support for the trolley-wire 2 at a point suitably distant from each switch, is mounted a current-box 15, consisting of a housing of any preferred form, constructed of non-conducting material, and preferably having an inner lid 16 and an outer cover 17. Within the box is a post 18, rigidly attached to the bottom of the box. In the upper end of this post and in the lid 16 are step-bearings for a rock-shaft 19, upon which are mounted two gears, the larger gear 20 being a spur-gear and loose upon the rock-shaft and the smaller gear 21 being a ratchet and made fast upon the rock-shaft. The spur-gear 20 is provided with a spring-pawl 22, which meshes with the teeth of the ratchet. Upon a separate shaft 23, stepped in a bearing in an arm 24 on the post and having support in a bearing in the lid 16, are a large spur-gear 25 and a small pinion 26, the latter meshing with the spur-gear 20 on the rock-shaft.

Upon the post 18, below the arm 24, is mounted a lever 27, its end being extended through an opening 29 in the wall of the box or housing 15. The projecting end of this lever is preferably bent or deflected, as shown in the drawings, in such manner as to bring its widened flat face into a vertical plane, or nearly so. The opening 29 in the wall of the box is of such length that it will permit said lever to turn upon the post 18 through part of a circle. Such movement of said lever may be produced by a force applied to its flat inclined outer end. In making such movement the lever comes in contact with and swings a hanging finger 30, which forms part of a bracket that projects laterally from the rock-shaft 19. This movement of the finger carries the rock-shaft 19 through part of a revolution, and as the small ratchet 21 is fast thereon it must move in unison with the shaft. If said movement is rapid, the teeth of the ratchet will merely slide under the spring-pawl 22 without imparting motion to the spur-gear 20. After reaching its limit of movement the lever is returned to its original position by a spring 31, which draws the hanging finger 30 back, and at the same time imparts motion in a like direction to the rock-shaft. By this motion the spring-pawl 22, which engages the teeth of the ratchet 21, compels the spur-gear 20 to turn, and thereby rotates the shaft 23 and large wheel 25 through the pinion 26. The main purpose of this gearing is to retard the motion of the parts when the lever is restored to its original position by the action of the spring 31. The reason for producing this retardation will be explained hereinafter.

Upon the end of the lever 27 which lies within the current-box is mounted a metallic conducting strip or band 32, which surrounds the end closely. Within the box, arranged in the arc in which the end of the lever 27 swings, is an insulating block or bracket 33, upon which are mounted metallic strips 35, substantially parallel with each other, their free ends being diverged, so that as said lever swings in one direction its metal-shod or conducting end may enter between said strips and have electrical contact with both. This construction, in short, is practically the same as that used in the ordinary knife-switch, the metal shoe or binding upon the end of each lever acting as a bridge for the current and enabling it to pass from one strip 35 to the other. To one of these strips, mounted on the block 33, a wire 36 is connected, by which current is brought from the trolley-wire or electrical main 2 or other suitable source of electrical energy over a suitably-insulated wire 36. The other strip 35 on the block 33 is electrically connected by a wire 38 to one terminal of the coil of the solenoid 7. From the other terminal the current goes to ground over a wire 40. It is evident that whenever the lever is operated in such manner as to throw its metallic end between the strips 35 the circuit of the solenoid-magnet will be completed and its core-bar 8 will be drawn longitudinally in such direction as to operate the bell-crank lever and move the switch-rail. The lever is operated in the following manner:

Upon the forked end of the trolley-staff 41, which carries the wheel 42, rolling on the electric conductor 2, I form or mount one or more spurs 43, which project laterally from the forked end of the staff. These spurs are preferably inclined upward, rearward, and outward, so that the angle they form with the axial line of the staff is not a right angle, the acute angle being upon the side of the spur which is next to the end of the fork. The length of the spurs and the position of the exposed end of the lever 27 are such that the spur will engage the flat vertical face of the lever as the trolley reaches the point where the current-box is located, provided, of course, that the box and the spur on the fork of the trolley are upon the same side of the electrical conductor or trolley-wire 2. When the spur engages the exposed end of the lever, the latter is swung, its outer flattened end moving in the direction the car is propelled, and by this movement the metallic or conducting end of said lever is thrown between the two contact-strips 35, thereby completing the circuit of the solenoid-magnet 7. The current-box being placed at a suitable distance from the switch, the rail is moved some little time before the car reaches the switch. The spur 43 passes off the outer end of the lever as soon as the latter reaches its limit of movement. The lever is returned by the spring 31 to its original position. This return movement is comparatively slow in order to maintain the circuit the proper length of time to enable the switch-rail to move to position, since the weight of said rail causes it to move somewhat slowly, and its impact upon the steel rail, toward which it is moved, may cause a slight rebound, and it is desirable to maintain the circuit until the movement is complete

and the rail at rest. For the same reason the conducting-strips 35, which complete the circuit of the solenoid-magnet, are of such length that the metallic or conducting end of the lever may move a suitable distance before passing out from between them.

In the description thus far given I have made no mention of the means by which each car is switched automatically at the proper point without requiring any attention from the motorman. My preferred manner of differentiating the switch-operating mechanism is by placing the current-boxes upon one side or the other of the electric main or trolley-wire and by shifting the positions of the spurs on the trolley-staff to different heights to correspond to the positions of the levers 27, by which the switches are shifted. For example, a single spur 43 may be placed on the upper or on the lower portion of the trolley-fork on the same side thereof. The angle at which these spurs are preferably formed causes them to incline outward, upward, and rearward relatively to the direction of movement to prevent them from hooking into and dragging down the trolley-wire support should the wheel accidentally slip off the trolley-wire.

In all ordinary cases, where the number of combinations is not great, the current-box will be provided with a single lever 27, and after the latter has been operated to complete the circuit of the solenoid 7 and move the switch-rail the lever will be returned to its normal position by the hanging finger 30 and spring 31 breaking the circuit and leaving the movable rail in the position to which it has been brought by energizing the solenoid 7. When it becomes necessary to restore the switch-rail to its original position, the car which will be controlled by such restoration has a spur upon its trolley-staff, which projects upon the opposite side of the trolley-wire. Upon the same side, at a suitable distance from the current-box already described, is a separate box 44, equipped like the one described in all substantial respects, the only differences being its location upon the other side of the trolley-wire and the connection of one of its contact-strips to one terminal of the solenoid-magnet 7^a instead of 7. The lever 27 in this box and the spur 43 on the trolley-staff are so arranged relatively to each other that the spur will engage and operate the said lever as the car passes, thereby completing the circuit of the solenoid-magnet 7^a and throwing the switch-rail back to its original position. By changing the boxes from one side to the other and placing the levers therein at varying points, the spurs on the trolley-staff being suitably located, I can effect a considerable number of automatic switch-controlling combinations. Should it be desired to increase the number of such combinations, I may use the duplex arrangement shown in Fig. 6, in which two separate levers 27 and 27^a are provided, each having its separate pair of contact-strips 35, each pair being mounted on a separate insulating-support. The external flattened ends of these levers are brought into substantial parallelism one above the other, and the strips 35 on the insulating-bracket 33 are arranged to open in a direction opposite to that in which the like strips on the separate insulating-bracket 34 open. These latter are also placed at one extremity of the range of movement of the conducting ends of the levers 27 and 27^a, while the contact-strips on the bracket 33 are at the other extremity. Thus if both levers are swung in the same direction one will be withdrawn from one pair and the other will be forced between the other pair of the contact-strips. The normal position of the levers in this duplex arrangement will be as shown in Fig. 7, with the conducting end of lever 27 lying between the contact-strips 35 on bracket 34, while the conducting end of the lever 27^a will be in the same vertical plane and entirely withdrawn from the other pair of contacts on bracket 33. The circuit of the solenoid-magnet 7 or 7^a, as the case may be, comprises a wire 45, which connects the second contact-strip of the first pair with the first contact-strip of the second pair, so that said circuit will be completed by merely throwing the conducting end of the lever 27^a between the second pair of contacts. If both levers are simultaneously operated, however, the circuit will be broken between the first pair and completed between the second pair of contact-strips 35. As these are shown in Fig. 7, it is evident that the simultaneous movement of both levers in the same direction will break the circuit by the withdrawal of the lever 27^a an instant before it is completed by the entrance of the lever 27 between the respective pairs of contacts, the result being that the switch remains unchanged. A trolley-staff having two spurs 43 upon the side next this duplex box will thus actuate both levers, but will not move the switch-rail, whereas a trolley-staff having a single spur properly placed will operate the lever 27, complete the circuit of the solenoid, and move the switch-rail. Either one or both of these levers are returned to the normal position by the hanging finger 30 and spring 31, as already described.

I may in some cases provide the single lever 27 with an external end of increased width, as shown in Fig. 2, whereby it will be operated by every car passing, provided the trolley-staff has either one or two spurs 43 on the same side with the current-box.

The usual arrangement at each switch is shown in the diagram in Fig. 5. It will be noted that two current-boxes are placed in this figure at different distances from the switch and upon opposite sides of the track. As illustrated, each of these boxes has but a single lever; but in all cases where the num-

ber of combinations is large each box will be equipped with two levers, as shown in Fig. 6.

A car which is to be switched upon the branch road will have its trolley provided with a combination of spurs, one of which will be so located as to operate the circuit-closing lever of the second box, which is the one nearest to the switch, by which the switch-rail is moved, and as the first box is passed without action the switch will remain in the position to which it is brought by the completion of the circuit in the second box. If, on the other hand, the car is to keep the straight track, the trolley is provided with an arrangement of spurs, which control the switches along the route, one of which spurs will operate the lever in the first current-box, by which the switch-rail is brought into the position shown in the drawings. These different results are effected by simply placing the spurs on different sides of the trolley. It may happen, however, that the car which is switched off the main track will come to points on the branch road where it is desirable that switches be operated in a manner that will require a spur or spurs on both sides of the trolley, one of which may be arranged at such a point that it will operate the lever in the first current-box in Fig. 5, thereby throwing the switch-rail into a position that would keep the car on the straight track. This is not important, however, because the spur engaging the lever in the second box, will restore the switch to proper position. Where two levers are used in each box, the action of the first box may be neutralized by operating both levers at once, as already described; but it will frequently be found preferable to arrange the spurs with reference to future combinations and in such manner that the circuit-closing lever in each box shall have operation. This will only be done, of course, when the second box will produce the necessary movement of the switch-rail. By the permutations possible with but four spurs, not more than two being placed upon the same side of the trolley, I am able to make at least fifteen distinct automatic actions, which will be more than will be necessary in any except rare cases. These spurs are so formed and arranged that if the trolley leaves the wire they cannot become hooked or engaged with the wire-supports and drag them down or break them. They have but slight lateral extension, and upon a metallic circuit they can be used without difficulty, while circuit-closers which lie in the same horizontal plane, but separated from each other by the necessary intervals, are totally impracticable. Moreover, it should be noted that in arrangements of the kind last mentioned the hub of the trolley and the necessities of such a construction would requrie a horizontal support that would extend at least eleven or twelve inches upon each side of the wire conductor in order to accommodate no more than four different circuit-closers, between which there is no interdependence in operation. Not only would such a structure impose a considerable weight on the trolley-pole, but in case the trolley should jump off the wire the horizontal support, standing at right angles to the wire, would drag down or destroy every supporting-bracket with which it is brought in contact before the car stops. It would be impossible, also, to use such a structure in an underground conduit for obvious reasons, and upon lines of any length and having the usual number of switches found upon lines in all large cities such a structure would be useless.

It is one principal object of my invention to place the control of the switches entirely out of the hands of the motorman. His attention should be given to other matters and should be undivided. The duty of watching for passengers who desire to board the car and avoiding danger to persons and vehicles is all that any man can properly perform, and if he is to watch for the switches, manipulate the overhead devices by which they are controlled, and satisfy himself that these devices have operated he must do so at the expense of frequent accidents.

Finally, my invention presents the important advantage that it has no exposed movable parts, which can be obstructed by freezing in cold weather, while overhead or underground apparatus, which must be manipulated by the motorman, is always liable to freeze up. Moreover, as a rope is necessary for the operation of the latter class of devices its use in underground conduits is practically impossible, as the slotway will speedily wear the rope asunder, and even under the most favorable circumstances the expense of supplying and maintaining ropes in cities like New York, where nearly three thousand cars are in daily use, is considerable.

Finally, in case of a blockade a car having a circuit-closing brush which rides on its contact until the switch is entirely passed holds the switch-rail with the whole force of the current from the moment the circuit is closed. Thus if the motorman should desire to keep the other track to avoid the blockade he would find it impossible to do so, as the action of the electrically-operated devices will either hold the switch-rail in or return it, if moved, to the position controlled by the circuit. By my invention, on the contrary, the circuit is interrupted when the switch-rail is operated, and the latter may then be moved by the foot or by any ordinary means.

What I claim is—

1. In an electric railway, the combination with a series of movable switch-rails at different points, of current boxes containing circuit closing levers having their ends arranged at different heights upon one side of the trolley wire, solenoid-magnets having core-bars connected to the switch-rails, and trolley-staffs upon the several cars having rigid spurs

arranged at different points upon the trolley-staff, whereby said spurs are enabled to engage the ends of the circuit-closing levers, placed at corresponding heights, substantially as described.

2. In an electric railway the combination with a series of switch-operating mechanisms of current boxes arranged at suitable points and having circuit closing levers the ends of which project from said boxes and are arranged at different heights near the trolley-wire, and a series of trolley-staffs upon successive cars having spurs projecting laterally and upward from one or both sides of the staff and at different heights, substantially as described.

3. In an electric railway, the combination with a movable switch-rail of a solenoid magnet, a lever connected to the core-bar and to the movable rail, a current-box having an insulating block having parallel strips, a circuit closing lever having one end shod with metal and adapted to pass between said strips, the other end extending outside the box and lying near the trolley wire, a spring actuated restoring mechanism, a train of gears to retard the action of said mechanism and a trolley staff having a spur projecting laterally from its fork, to operate the circuit closing lever, substantially as described.

4. In an electric railway, the combination with a movable switch-rail of a solenoid magnet, a lever connected to the core-bar and to the movable rail, a current-box having an insulating block having parallel strips, a circuit closing lever having one end shod with metal and adapted to pass between said strips, the other end extending outside the box and lying near the trolley wire, a spring actuated restoring mechanism, a train of gears to retard the action of said mechanism and a trolley staff having a spur projecting laterally from its fork, to operate the circuit closing lever, substantially as described.

5. In an electric railway, the combination with a movable switch-rail of a solenoid magnet, a lever connected to the rail and to the core-bar of the magnet, a circuit-closing lever arranged in a current-box placed on one side of the trolley-wire, a trolley-staff having a spur projecting laterally from its fork and adapted to engage the exterior end of the circuit-closing lever, a spring-actuated restoring device and a train of gears adapted to be driven by and to retard the movement of said restoring device, substantially as described.

6. In an electric railway, the combination with an electrically operated switch-rail of two independent levers arranged in a current-box upon one side of the trolley-wire and having conducting ends, two separate pairs of electrically connected contact-strips arranged at opposite ends of the range of movement of said levers, an automatic restoring device for returning said levers to their normal position, and a circuit for the switch operating devices including both pairs of contact strips, substantially as described.

7. In an electric rail-way, the combination with a movable switch-rail of a solenoid magnet, a lever connected to the core-bar and to a movable switch-rail, two current-boxes placed one on each side of the track at different distances from the switch, circuit-closing levers arranged in said boxes and having extension outside the same, their conducting ends being adapted to pass in and out from between metallic conducting strips, a circuit for the solenoid from each box, including the conducting-strips, and a trolley staff having laterally inclined spurs upon its sides adapted to engage and operate the circuit-closing levers in one, or both, boxes, substantially as described.

8. In an electric railway, the combination with a movable switch-rail of a solenoid magnet, a lever connected to the core-bar and to the switch-rail, two separate current boxes, one on each side the track and at different distances from the switch, two independent circuit making and breaking levers in each box, two independent pairs of conducting strips arranged at opposite ends of the range of movement of the levers, a separate circuit for each current box and the solenoid, including both pairs of conducting-strips, and a trolley staff having one or more spurs on its sides arranged at a height corresponding with the lever, or levers, to be operated in either, or both boxes, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

ROBERT V. CHEATHAM.

Witnesses:
E. C. PEARSON,
I. B. WEBSTER.