No. 769,214. PATENTED SEPT. 6, 1904.

T. F. GAYNOR.

BLOCK SWITCH AND SIGNAL SYSTEM FOR ELECTRIC RAILROADS.

APPLICATION FILED AUG. 19, 1902.

NO MODEL. 5 SHEETS—SHEET 1.

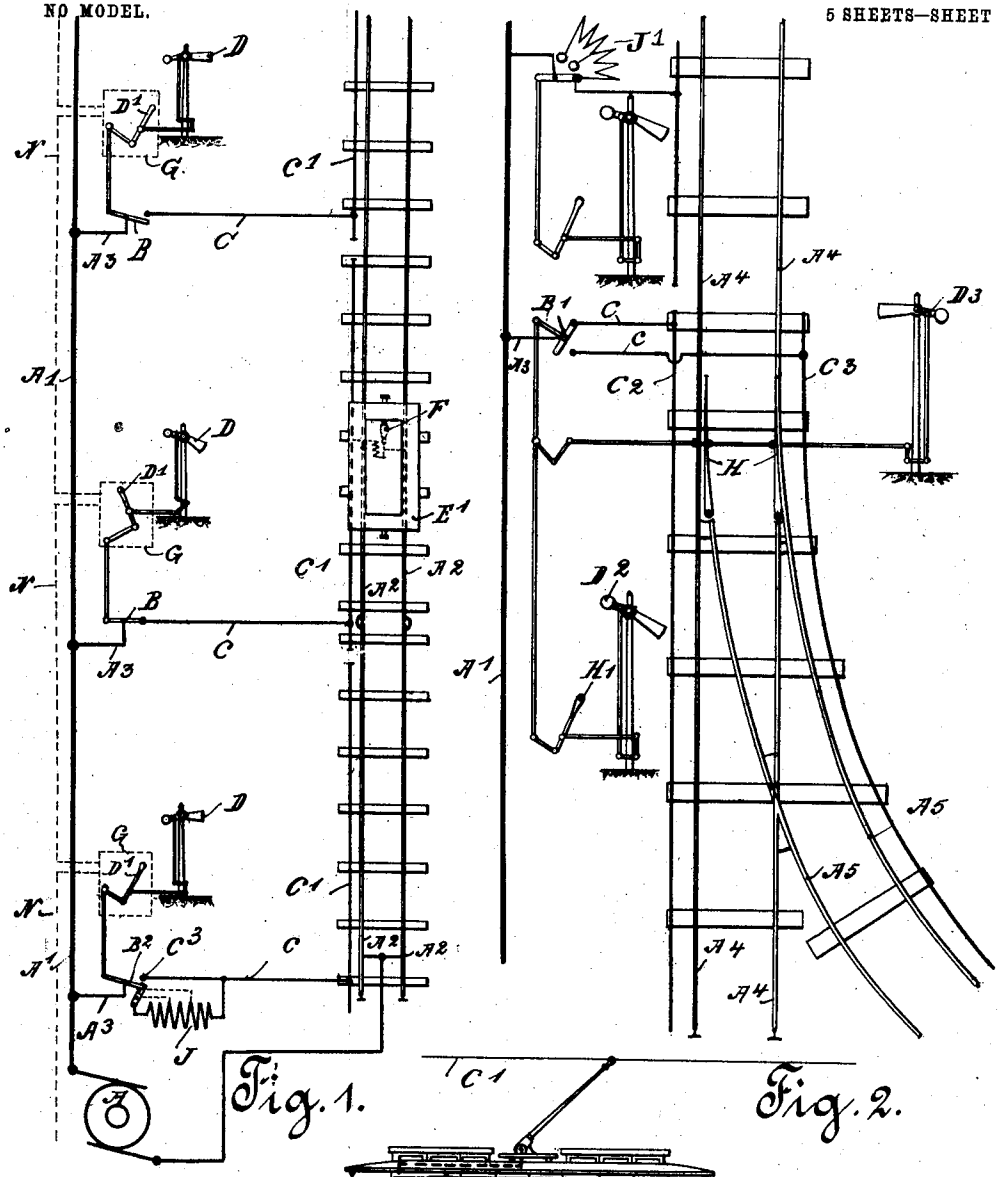


Fig. 1.

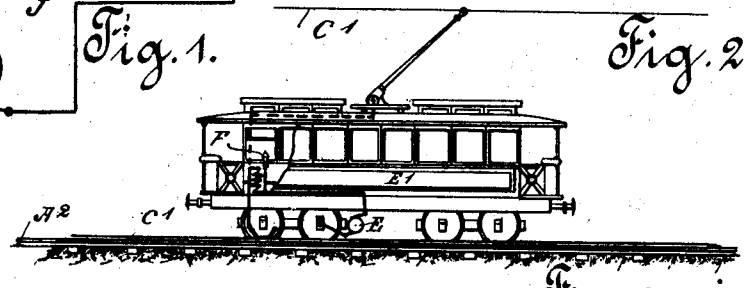


Fig. 2.

Fig. 3.

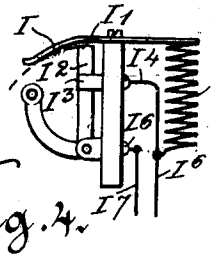


Fig. 4.

WITNESSES:

F. M. Rochrich

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No. 769,214. PATENTED SEPT. 6, 1904.

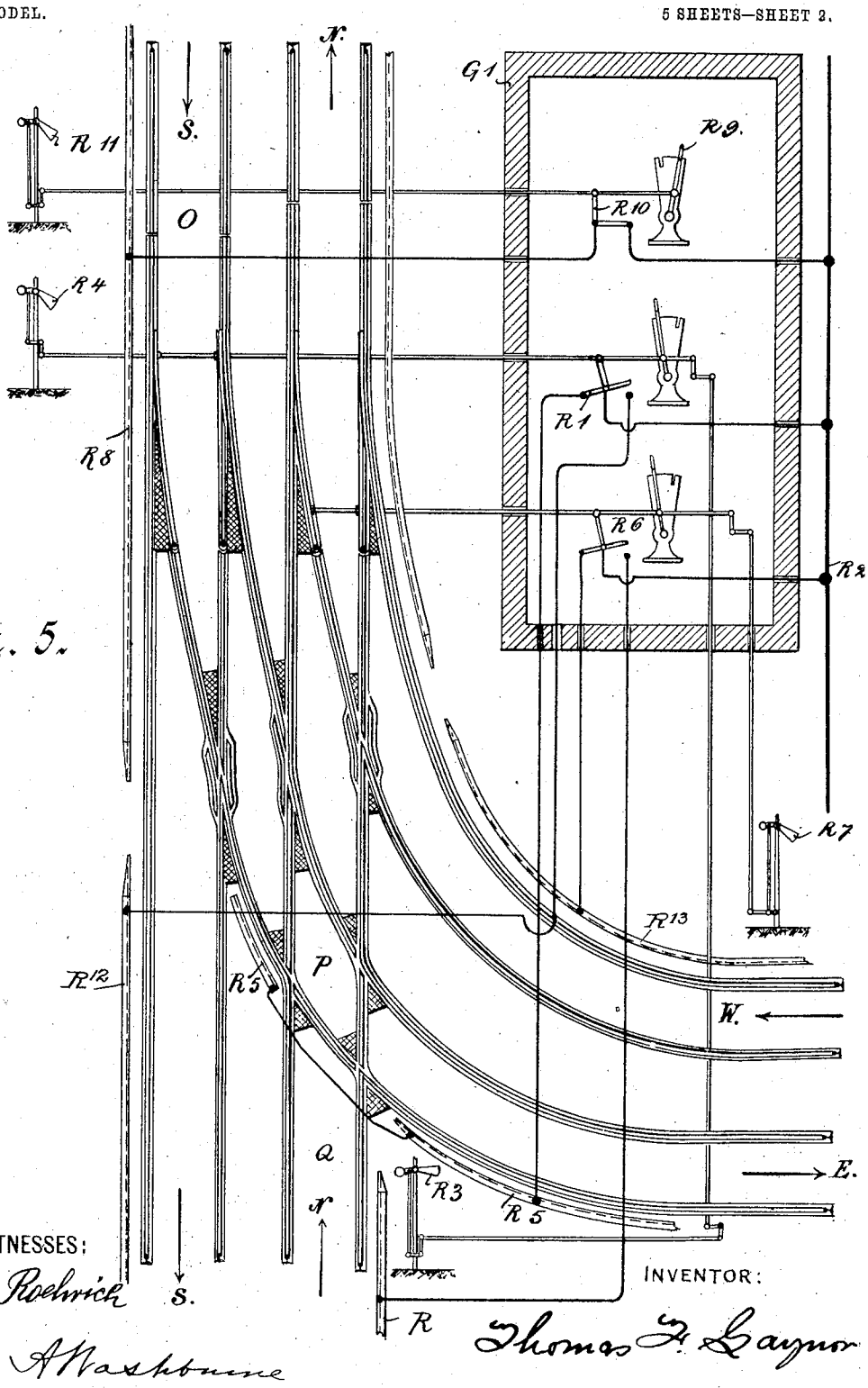
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NO MODEL. 5 SHEETS—SHEET 2.

Fig. 5.



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NO MODEL. 5 SHEETS—SHEET 3.

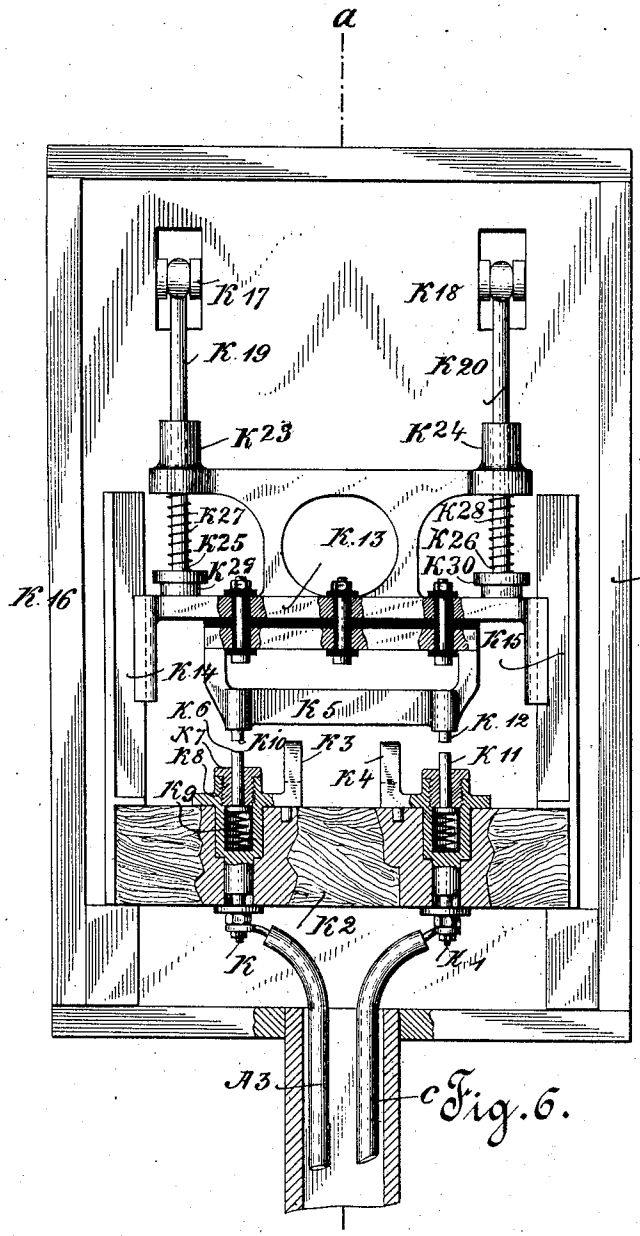


Fig. 6.

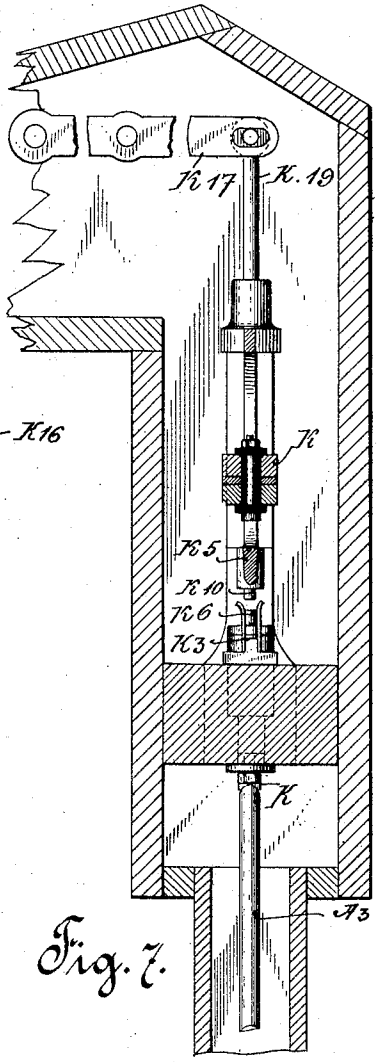


Fig. 7.

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NO MODEL. 5 SHEETS—SHEET 4.

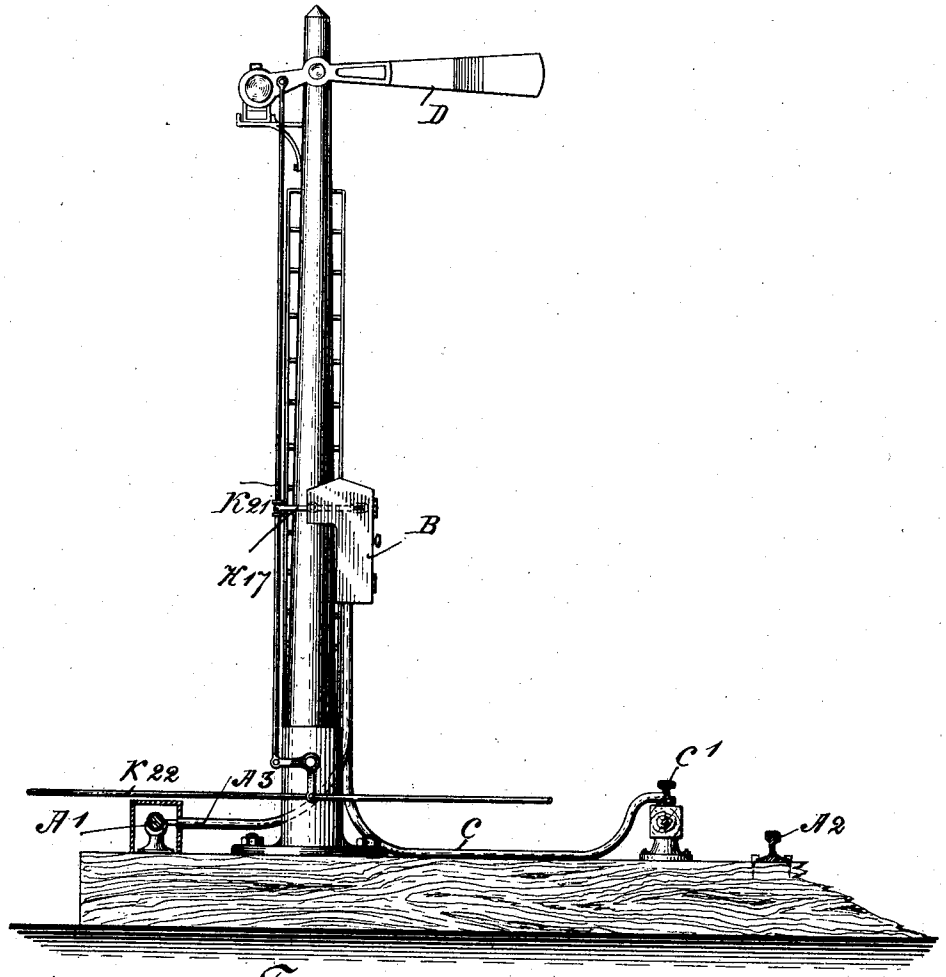


Fig. 8.

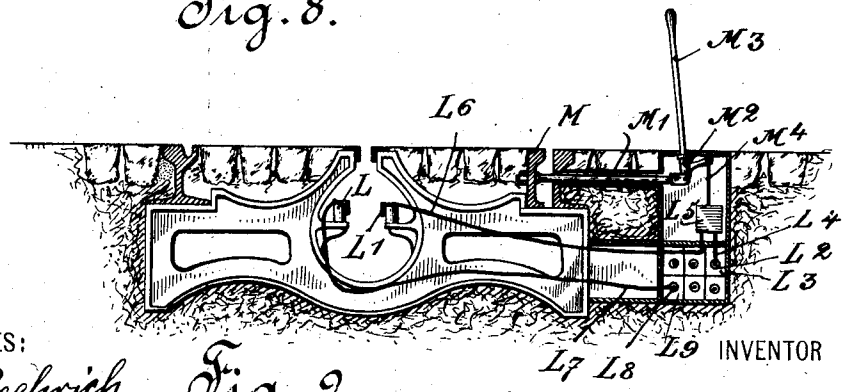


Fig. 9.

WITNESSES:

F. M. Roehrich

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BLOCK SWITCH AND SIGNAL SYSTEM FOR ELECTRIC RAILROADS.

APPLICATION FILED AUG. 19, 1902.

NO MODEL. 5 SHEETS—SHEET 5

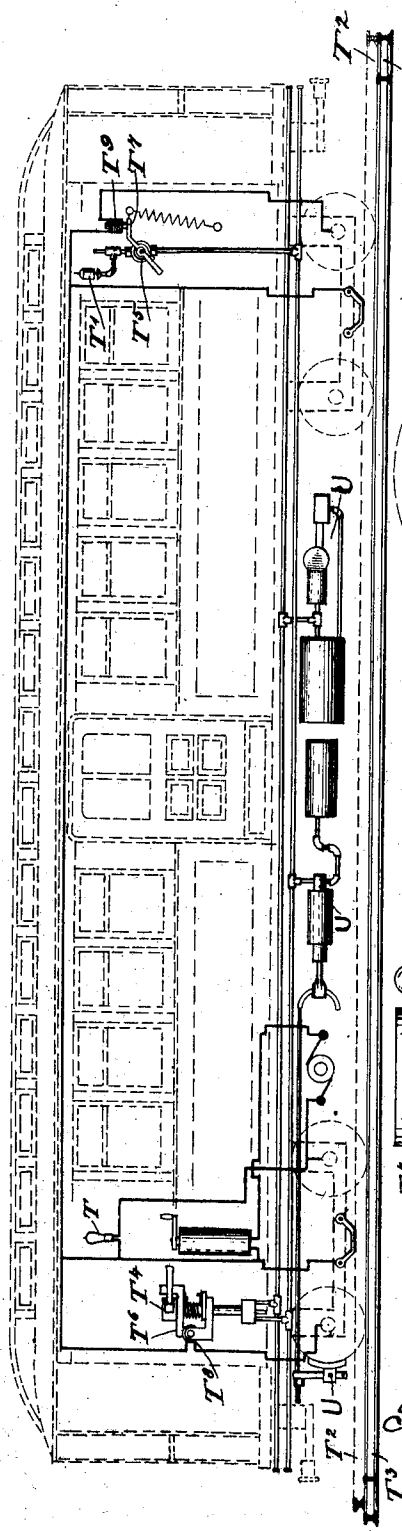


Fig. 12.

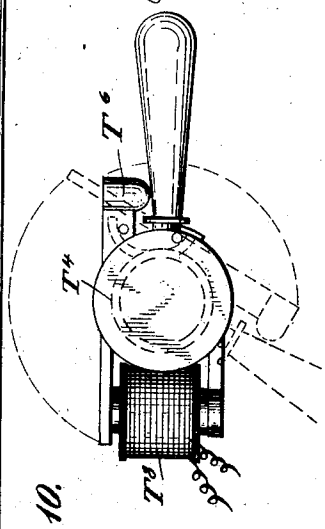


Fig. 10.

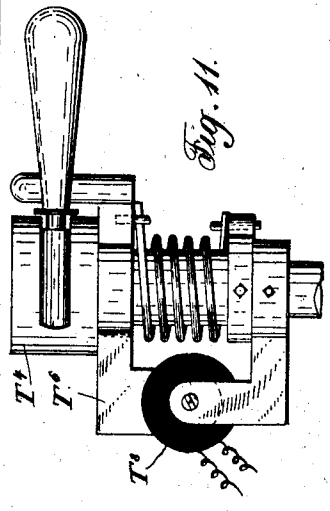


Fig. 11.

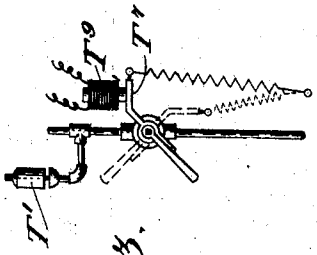


Fig. 13.

WITNESSES:

F. N. Rochrich

Wm. A. Washburn

INVENTOR

Thomas F. Gaynor

No. 769,214. Patented September 6, 1904.

UNITED STATES PATENT OFFICE.

THOMAS F. GAYNOR, OF BROOKLYN, NEW YORK, ASSIGNOR TO GAYNOR TRAIN CONTROL COMPANY, A CORPORATION OF NEW JERSEY.

BLOCK SWITCH AND SIGNAL SYSTEM FOR ELECTRIC RAILROADS.

SPECIFICATION forming part of Letters Patent No. 769,214, dated September 6, 1904.

Application filed August 19, 1902. Serial No. 120,204. (No model.)

To all whom it may concern:

Be it known that I, THOMAS F. GAYNOR, a citizen of the United States, and a resident of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Block Switch and Signal Synchronous Systems for Electric Railroads, of which the following is a specification.

This invention relates to improvements in block switch and signal systems for electric railroads of the class in which the electric current is supplied to the car-motor mechanism through a conductor parallel and in proximity with the track and the motor mechanism having a running contact with the conductor, as a trolley-wire, third rail or underground connection, or the like.

My invention consists in constructing the contact-conductor in separate sections or blocks and having each section connected with the main feed-conductor by a mechanical electric switch and branch conductor and the electric switch being so connected with a signal mechanism that when the electric switch is operated the proper section of the contact-conductor is electrically connected with or disconnected from the main feed-conductor and the signal simultaneously mechanically actuated to indicate the electrical condition of that section or "block" of the track to the motorman and also the meaning of the signal itself as to the danger or safety of moving forward on the track, and vice versa.

My invention further consists in so connecting a track-switch and mechanical signal mechanisms, or either of them, separately with the electric-switch mechanism that the operation of the track-switch mechanism or the signal mechanism (or both, if so arranged) will also actuate the electric-switch mechanism simultaneously, and thus electrically connect or disconnect the proper section of the contact-conductor, according as the elements of "safety" or "danger" are involved therewith, to a car at that point on a road.

My invention also consists in providing in connection therewith electric cars with electric and audible signal devices and car braking and stopping mechanism and such other forms of construction and means for operating an electric-railroad system, as will be more fully hereinafter set forth, and especially pointed out in the claims.

The objects of my invention are to enable train despatchers, signal operators, switchmen, motormen, and others in charge of the operation of electric-railroad motive power to control the movement of the cars more safely and effectively than can be done by existing means and as will be more fully described in the following specification, taken in connection with the accompanying drawings, forming part thereof.

In the drawings, Figure 1 is a diagram of a railroad provided with my improvement, showing the contact-conductor in three sections or blocks, each of which has a separate switch connection between the feed-conductor and the contact-conductor and a corresponding signal mechanism and operating-station. Fig. 2 is a diagram of a section of a railroad having a track-switch connection provided with my improved feed-conductor-connecting switch and signal mechanism. Fig. 3 represents a side elevation of a motor-car having "third-rail" and "trolley-wire" contact-conductor connections and showing a signal mechanism within the car consisting of an electric lamp. Fig. 4 shows an electric-switch device, having a double contact and resistance to reduce and prevent "sparking" when the circuit is broken. Fig. 5 represents a section of a double track and two track-switch connections and showing how the contact-conductors and feed-conductors may be connected and signals applied and operated from a station according to my invention. Fig. 6 represents a front elevation, partly in section, of a successive double-contact electric switch for minimizing the effects of sparking when the connection between the feed-conductor and the contact-conductor is broken. Fig. 7 is a side vertical sectional view, line *a b*, Fig. 6. Fig. 8 is a front elevation of a signal and electric-switch mechanism, showing connections with feed-conductor and a third rail as a contact-conductor. Fig. 9 is a vertical sec-

tional view of a track-switch and feed-conductor-connecting electric-switch mechanism of a surface railroad having the contact-conductors below the surface of the ground. Fig. 10 represents a motor-car provided with visual and audible signal devices and air-brake mechanism and shows how my improvement can be applied thereto and the movement of the car be controlled as the current is interrupted by the operation of the electric-switch mechanism. Figs. 11, 12, and 13 are enlarged views of the electromagnetic valve-controlling devices shown in Fig. 10.

Similar letters refer to similar parts throughout the several views.

In the drawings, A represents an electric generator, having circuit connections with feed-conductor A′ and track-rails A^2 A^2 in the usual manner of railroad construction. Branches A^3 A^3 connect, through the switches B B and branches C C, with the contact-conductors C′ C′, and which may be either a trolley-wire above the track or a third rail alongside of it or bars beneath the surface of the ground, as shown in Figs. 3, 8, and 9, respectively.

The electric switches B B are mechanically connected with the signal mechanisms D D, so that the manipulation of their respective levers D′ D′ will cause the signals D D to indicate the condition of the corresponding block of the track as to the safety or danger of a motor-car proceeding farther forward, while the current is at the same time let into or cut off from the proper section of the contact-conductor C′ and both results being obtained synchronously.

The motor mechanism E of the car E′ is in circuit between the contact-conductor C′ and the rails A^2 A^2 in the usual manner, and the motive power is therefore supplied to the car E′, according as the electricity is let into the contact-conductor C′, by the manipulation of the switch D of the block in which the car is at the time.

A signal F, consisting of an electric lamp, is placed in the car E′ and so arranged as to be in circuit whether the motor is so or not, so that whenever a switch D is operated and the current affected the lamp F will indicate the fact instantly, and thus give the switch or signal operator signal communication with the motorman in the car E′ if the car is upon the proper block to be thus signaled.

As a manipulation of the switch B will cut off the current from the contact-conductor C′, and consequently from the car E′, at the same time the visual signal D indicates "danger," it can be seen that the motorman could not proceed forward with the car E′ even if he forgot or misunderstood the signals or the danger of so doing, as he could not energize the motor E through having no current in the contact-conductor C′.

The main novel principle of construction in this invention is in having the contact-conductor C′ divided in separate sections corresponding with the blocks in which the railroad is also divided and in having corresponding electric-switch stations G G at suitable points alongside of the track, where the operators can control the movement of the cars by operating the switches B B and letting the electricity into the contact-conductors or shutting it off or reducing its strength, according as the cars are to be permitted to proceed or not and as illustrated in Fig. 1.

In Fig. 2 a track-switch mechanism H is shown in connection with the main track A^4 A^4 and the electric switch B′ connecting the contact-conductor C^2 of the main track A^4 A^4 and the contact-conductor C^3 of the branch track A^5 A^5 with the feed-conductor A′ in such a manner that when one of the contact-conductors is connected with the feed-conductor A′ the other is disconnected, and vice versa. This track-switch H is manipulated by the lever H′, that operates the electric switch B′ and also the signals D^2 D^3, either one of which indicates "danger" when the other shows "safety" and according as the right of way is to be given over the main track A^4 A^4 or the branch track A^5 A^5 to one car while another one is to be held and allowed subsequently to proceed. This construction shows how the track-switch, the electric switch, and the signal mechanisms all work synchronously by a single manipulation of the lever H′ and rendering it impossible for more than one car to have or use the right of way over either track at this point at the same time.

Fig. 5 shows two main straight tracks and two branch tracks and having track-switch connections and the tracks being designated by the arrows as for "north-bound," "south-bound," "east-bound," and "west-bound" cars, respectively. A station G′ is also shown near the junction of the tracks containing the electric-switch, track-switch, and signal operating mechanisms and the construction of which being as previously described. This figure shows the adaptability of my invention to a double-track junction and a crossing construction and as will be more fully hereinafter explained.

While any suitable electric-switch device can be used to open or close the circuit between the feed-conductor and the contact-conductor or regulate its intensity or strength, yet to prevent or minimize the sparking of the switch when the circuit is broken I show two forms of construction of a switch for this purpose in Figs. 4, 6, and 7, that can be used and which will be described.

In Fig. 4 a "knife-switch" is shown having a spring I, which makes contact with the end I′ of the blade I^2 before the latter breaks contact with the fork I^3 of the terminal I^4. A resistance-coil I^5 is connected with the spring I and the terminal conductor I^6, so that the

circuit is established through the resistance-coil, the spring, and the blade from the conductor I^6 to the conductor I^7 when the blade is drawn away from the fork I^3, as indicated by the dotted lines, and the strength of the current is thus minimized before the blade is finally drawn from the spring, and the sparking is thus obviated. The spring and blade can be left in contact if the resistance is to remain in as a shunt-circuit and the contact-conductor is not to be entirely deënergized, but having therein a current of weak intensity or strength, and the resistance is suitably designed to prevent undue heating effects.

In Fig. 1 the electric switch B^2 is shown provided with a resistance J arranged according to this construction, the resistance-coil being looped in between the switch and the branch conductor C, connecting with the contact-conductor C′ before the switch-blade breaks contact with the branch-conductor terminal C^3, and a rheostat J′ is shown in Fig. 2. The dotted lines in connection with the resistance-coil J indicate how the coil can also be connected up as a rheostat.

In Figs. 6 and 7 the branch-conductor terminals K K′ are mounted in an insulating-block K^2, having the usual spring contact-forks K^3 K^4, into which the circuit-closing blade K^5 slides when the switch is operated. A piece of carbon K^6 is loosely fitted into a suitable sleeve K^7 in the terminal K, having a disk K^8 and a spring K^9 thereunder and adapted to push the carbon upwardly against the end of a corresponding carbon K^{10}, secured in the blade K^5, as the latter is brought into contact with the forks K^3 K^4. A similar carbon arrangement K^{11} is provided in the other terminal K′ and the blade K^5, having a corresponding carbon K^{12} in registering positions therewith. The blade K^5 is insulatedly mounted upon a slide K^{13} and fitted between the guides K^{14} K^{15} in the frame K^{16}, so that the movement of the levers K^{17} K^{18} through the connecting-rods K^{19} K^{20} will impart a vertical motion to the blade K^5 and make and break the circuit through the terminals K K′.

The levers K^{17} K^{18} are connected by the rod K^{21} with the main operating and signal mechanism K^{22}, as seen in Fig. 8, and work synchronously therewith. (See Fig. 8.)

The connecting-rods K^{19} K^{20} are loosely fitted in the upper extremities K^{23} K^{24} of the slide K^{13}, and their lower ends K^{25} K^{26} impinge against the slide by the pressure of the springs K^{27} K^{28} against the collars K^{29} K^{30}, secured to the rods for this purpose. This spring mechanism is for the purpose of moving the blade quickly away from the forks when it is detached therefrom and to minimize the effects of sparking upon the switch mechanism when the circuit is broken.

The space between the blade K^5 and the terminal forks K^3 K^4 is greater than that between the terminal carbons K^6 K^{11} and the blade-carbons K^{10} K^{12}, so that the carbons will make contact before the blade closes contact with the terminal forks as the switch is depressed, and they keep contact longer than the blade does with the forks, as the blade is elevated, which causes the carbons to take the sparking effects exclusively, as the switch breaks circuit when it is operated. The carbons being inexpensive are easily duplicated when worn out, and in this way the blade-closing mechanism is preserved. The springs under the lower carbons yield to the downward pressure of the upper carbons in contact and allowing the blade and terminal forks to close the circuit.

In Fig. 9 there are two contact-conductors L L′ shown, as this is the usual form of electric street-car construction in the large cities where the conductors are "underground" and the motor mechanism making connection with the conductor through a narrow slot in the roadway between the tracks. The main feed-conductor L^2 is in a conduit L^3 and has a connection L^4, through the electric switch L^5 and branch L^6, with the contact-conductor L′. The other contact-conductor L is connected by the branch L^7 with the return feed-conductor L^8 in the conduit L^9. M represents a track-switch connected by the rod M′ to the lever M^2, having the handle-bar M^3 detachably fitted thereto. The electric switch L^5 is also connected by the rod M^4 to the lever M^2, so that the operation of the lever actuates the track-switch and the electric switch, simultaneously cutting off the current or letting it into the contact-conductor L′, according to the position of the track-switch with reference to the main track.

The construction of my improvement will be more fully illustrated by describing its operation and advantages, which will now be explained.

Referring to Fig. 1, three blocks of an electric-railroad system are shown corresponding to the sections into which the contact-conductor C′ is divided and which will be designated as the "upper," "middle," and "lower" blocks, respectively, for purposes of illustration. A car is shown upon the middle block, but from which it is not to be permitted to pass through the lower block for the time being. The operator in the lower station sets the lever D′ in the position shown, which brings the signal D to "danger" and operates the switch B^2, so as to open the circuit between the feed-conductor A′ and the contact-conductor C′ at C^3, and thereby cutting off all the current from the contact-conductor, and consequently from the motor mechanism of the car, (excepting a weak current passing through the resistance J, if the latter is in circuit,) thus interrupting the motive power of the car when the latter gets on the lower block and extinguishing the sig-

nal-lamp F therein. If the motorman should disregard the visual signal D alongside of the track, his attention would be nevertheless called to the situation by the signal-lamp and lack of sufficient electricity in the car, and if he disregarded all of these indications the car, if in motion, would only move as much as its momentum carried it forward even if the the brakes were not applied to stop it, and it would soon come to a stand. If the operator in the middle station wished to hold the car in his block, he could do so by manipulating his station mechanism accordingly. If a car was standing on the upper block, it could not move until the current was given to the contact-conductor of that section by the station operator of that block operating the proper mechanism in his station accordingly. As the stations of railroad block systems usually have telegraphic or telephonic connection with each other, and which is indicated by the dotted line N in Fig. 1, cars can be run over this system by either the "absolute" or "permissive" principles of block-system operation.

The station-points G G G, where the electric-switch and signal devices are established, are located along the route of the track connecting up the insulated sections C′ C′ C′ of the contact-conductor successively and may be in constant charge of special operators or trackmen, or if not they may be accessible to motormen or train crews, so that when a car or train stops for any reason at any point on the track the motorman can cut out the current from the section or sections of the contact-conductor that his car is on or near and give appropriate signals and warning in each direction from his car, and thereby prevent other cars from moving toward his car and coming into possible collision therewith.

In Fig. 2 the synchronous principle and advantages of this system can be clearly seen.

The operation of the track-switch H by the lever H′ into the position shown gives a car the right of way over the main track, while indicating "danger" on the signal D^3 to the track A^5 A^5 and cutting out of circuit its contact-conductor C^3 and all of these results being obtained simultaneously together. When the right of way is to be given to the track A^5 A^5, a reversal of the lever H′ to the position shown in the middle station G, Fig. 1, brings the track-switch H into proper position, energizes the contact-conductor C^3 of that track, signals "safety" on the signal D^3, and at the same time cuts out of circuit the contact-conductor C^2 of the lower section of the track A^4 A^4 and signals "danger" on the signal D^2 for that track. By this arrangement a car can move toward the track-switch from but one of the tracks at a time, as the contact-conductor of only one of the tracks is ever energized at a time, thus preventing any possible collision of cars coming over the two tracks and approaching the switch H together.

Fig. 5 represents a section of a double-track electric railroad with switch-crossing and branch connections and like one upon which a disastrous collision occurred recently, the application of this invention thereto and its advantages, had it been in use, can be clearly seen. In the case referred to an east-bound train at O, having the right of way, had reached the crossing-point P when it was run into by a north-bound train coming from the point Q and whose motorman disregarded the danger-signal for his track. By the arrangement herein shown the contact-conductor R of the north-bound track would have been without current through being cut off by the switch R^6 from the feed-conductor R^2, and having no current he could not have moved his train to the danger-point P through lack of electric motive power. He would also have had the lamp-signal F in his car (see Fig. 3) to also warn him even if he failed to observe the visual signal R^3 of his track. The signal R^4 would have indicated "safety" to the motorman of the east-bound train, and he would have had the contact-conductor R^5 of his track energized to carry his train forward through being in circuit by the switch R′ with the feed-conductor R^2. If a north-bound train was to be held and a west-bound train given the right of way, the contact-conductor R of the north-bound track would be cut out by the switch R^6 in the same manner and the north-bound train accordingly held, while the west-bound train would be signaled by the signal R^7. The lever R^9 operates the circuit-closing switch R^{10} for the contact-conductor R^8 of the south-bound track and also the signal R^{11} for the latter, and thus gives control over that track. The switch mechanism R^{10} gives independent control of east-bound and south-bound trains. Similar independent combined electric switch and signal devices (not shown) can be provided for the north and west bound tracks, thus giving absolute control of the movement of all trains on all the tracks at this junction-point in connection with and independent of the double alternate switch and signal devices R′ R^6 and as can be understood without illustration or further description. The switch R′ connects the contact-conductor R^5 of the east-bound track and the contact-conductor R^{12} of the south-bound track alternately with the feed-conductor R^2, and the switch R^6 similarly connects the contact-conductor R of the north-bound track and the contact-conductor R^{13} of the west-bound track. By the manipulation of either one of these switches R′ R^6 the right of way can be given to only one train at a time over either one of their respective tracks. The intersection of the north and east bound tracks at the point P is a complete crossing, and the application

of this invention thereto can be understood without further explanation.

In Fig. 10 the signal mechanism is shown as consisting of an electric lamp T and an electromagnetic air-whistle T′ in circuit between the contact-conductor T^2 and the rails T^3 T^3.

The air-brake mechanism U U U shown is of the usual standard construction as now in general use on electric cars and can be understood without further explanation. The air-valves T^4 T^5, however, are provided with electromagnetic spring-tension controllers T^6 T^7, the magnets T^8 T^9 of which are in circuit between the contact-conductor and the rails and while energized by the current magnetically hold the controllers away from the valve-levers; but when the current is interrupted by the electric-switch mechanism and the magnets are deënergized the controllers are free to actuate the valve-levers, and thus open the valves and let the air blow through the whistle and automatically apply the brakes and in the usual manner stop the movement of the car as quickly as possible and also give an audible signal. In this way the signal operator also has control of the car, as he can hold it on his block by properly manipulating his station switch mechanism which controls the current through the contact-conductor, and consequently the car-motor, and applies the car-brakes at the same time.

So far as controlling the movement of electric motor-cars or locomotives by reducing the intensity or strength of the current in the contact-conductors or by shutting it off entirely is concerned either plan may used according to my invention, as the main object is to prevent when desired sufficient electricity from going through the car motor mechanism to move the car, and this result can be obtained as well by reducing the intensity or strength of the current low enough as by cutting it out entirely.

The resistance devices shown and described show how the current can be reduced in intensity or strength in the contact-conductor, and the switches show how it can be cut out entirely. The resistance devices shown in connection with the switches also illustrate how the current intensity or strength can be reduced before the circuit is completely broken, and thus minimizing the effects of "sparking."

Whether it is better or not to cut out the current entirely from the contact-conductor or only reduce its voltage or amperage, or both, sufficiently in practice depends upon the special conditions under which a system is constructed, such as location, electromotive force, as well as the ampere strength normally of the electric current, frequency of trains, accessibility of the mechanism, and other conditions that should be first known and considered.

This invention is not intended in any way to lessen the responsibility of either the motorman or the station or the switch operators in the exercise of their duties, but is intended to provide a better means for more safely and effectively operating cars, locomotives, and trains on electric railroads than now exists and which can be accomplished in the manner set forth.

This invention is applicable to surface railroads having the aerial or "trolley-wire," the "third-rail" or "underground" system of conductors or for elevated railroads, bridges, tunnels, subways, and all systems in which the electricity is obtained from a contact-conductor parallel with the track.

In can thus be seen that I provide a novel mechanism, method, and system for controlling the movement of motor-cars and trains over electric railroads in a safe and advantageous manner and without changing the construction of the track, cars, motor mechanism, or the electric equipment of the plan of electric railroads now in general use throughout the world and regarded as the standard plan and that my invention is in every way operative, applicable, and complete for the purposes intended and as set forth and described.

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

1. In an electric railroad, the combination of the resistance, J, connected between the feed-conductor, A′, and contact-conductor, C′, through branch connections, A^3, and C, and the actuating-lever, D′, connecting the signal, D, electric-switch and resistance mechanism, B^2, and adapted to actuate the switch, the signal and the resistance mechanisms synchronously, substantially as specified.

2. In an electric railroad, the combination of the track-switch, H, mechanically connected with the signals, D^2, D^3, and the electric switch, B′, adapted to connect the feed-conductor, A′, with contact-conductors, C^2, C^3, of the tracks, A^4, A^4; A^5, A^5, alternately, and the actuating-lever mechanism, H′, substantially as specified.

3. In an electric railroad, the combination of the track-switch, H, mechanically connected with either one of the signals, D^2, D^3, and the electric switch, B′, adapted to connect the feed-conductor, A′, with contact-conductors, C^2, C^3, of the tracks, A^4, A^4, A^5, A^5, alternately, and the actuating-lever mechanism, H′, substantially as specified.

4. In an electric railroad, the combination of the track-switch, H, and the electric switch, B′, adapted to connect the feed-conductor, A′, with contact-conductors, C^2, C^3, of the tracks, A^4, A^4, A^5, A^5, alternately, and the

actuating-lever mechanism, H′, substantially as specified.

5. In an electric railroad, having a feed-conductor and a contact-conductor, a track-switch mechanism connecting two or more tracks having combined therewith a mechanical electric-switch mechanism connecting the feed-conductor and the contact-conductor, and all combined, substantially as specified.

6. In an electric railroad, the combination of the generator, A, the track-rails, A^2, A^2, the feed-conductor, A′, the series of contact-conductor sections, C′, C′, C′, and the series of controlling manual combined electric-switch and mechanical signal mechanisms, B D D′, B D D′, B^2 D D′, each connecting its contiguous section of the contact-conductor with the feed-conductor through a pair of branch conductors, A^3, C, and said mechanisms being located at successive operating-points, G, G, G, stationed along the route of the track and corresponding with the contact-conductor sections, substantially as specified.

7. In an electric railroad, having a feed-conductor and a contact-conductor, a combined mechanical signal and track-switch feed-conductor and contact-conductor connecting electric-switch mechanism, the track-switch connecting two or more tracks, substantially as specified.

8. In an electric railroad, having a feed-conductor and contact-conductor, the combination therewith of a track-switch mechanism connecting two or more tracks and having a mechanical signal and a feed-conductor and contact-conductor electric-switch mechanism connected therewith adapted to thereby interrupt the electric current in a section of the contact-conductor and to actuate the signal synchronously, substantially as specified.

9. In an electric railroad, a resistance and mechanical electric-switch mechanism provided with a signal and connecting a contact-conductor and a feed-conductor, and combined, substantially as specified.

10. In an electric railroad, the combination of a feed-conductor, a resistance, a contact-conductor, and a mechanical mechanism provided with a signal and for connecting or disconnecting the resistance between the feed-conductor and contact-conductor, substantially as specified.

11. In an electric railroad, the combination of an electric generator, a feed-conductor, a contact-conductor and a mechanical electric switch connecting the feed-conductor and contact-conductor, and an electric car provided with a signal in circuit with and operated by said switch, substantially as specified.

12. In an electric railroad, the combination of an electric generator, a feed-conductor, a contact-conductor and a mechanical electric switch connecting the feed-conductor and contact-conductor, and an electric car provided with an air-brake mechanism in circuit with and operated by said switch, substantially as specified.

13. In an electric railroad, the combination of an electric generator, a feed-conductor connected therewith, a contact-conductor divided into a series of successive insulated sections, each section being connected with the feed-conductor by a corresponding intermediate manual electric-switch mechanism provided with a mechanical signal, and all arranged, substantially as specified.

14. In an electric railroad, the combination of an electric generator, a feed-conductor connected therewith, a series of mechanical electric-switch and signal mechanisms located at successive station-points along the route of the track, a corresponding series of successive insulated sections of a contact-conductor each of which is connected with the feed-conductor through a contiguous intermediate one of the electric-switch and signal mechanisms and by the manipulation of which the electrical condition of the contact-conductor sections can be regulated and changed and appropriate signals given to the car or train and its movement on the track thereby directed and controlled, substantially as specified.

15. In an electric railroad, the combination of an electric generator, a feed-conductor, a return-conductor, a series of successive insulated sections of a contact-conductor parallel and in proximity with—but independent of—the track-rails, a corresponding series of manual mechanical electric-switch mechanisms located at successive station-points along the route of the track—each one of which being the sole means of electrically controlling its contiguous section of the contact-conductor with the feed-conductor, with a car provided with a motor mechanism in circuit between the contact-conductor and the return-conductor and controllable in its movement along the track by the manipulation of the said electric-switch mechanisms, substantially as specified.

Signed at New York, in the county of New York and State of New York, this 16th day of August, A. D. 1902.

THOMAS F. GAYNOR.

Witnesses:

JULIUS NELSON,

JAY E. LAWSHE.