(No Model.) 2 Sheets—Sheet 1.

J. H. GUEST.

SUPPLY SYSTEM FOR ELECTRIC RAILWAYS.

No. 537,197. Patented Apr. 9, 1895.

Fig. 1.

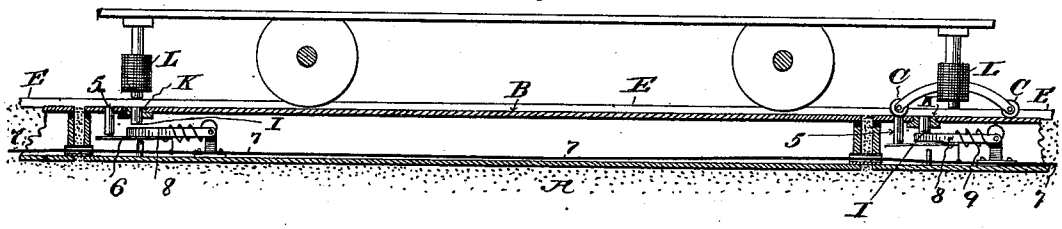


Fig. 2.

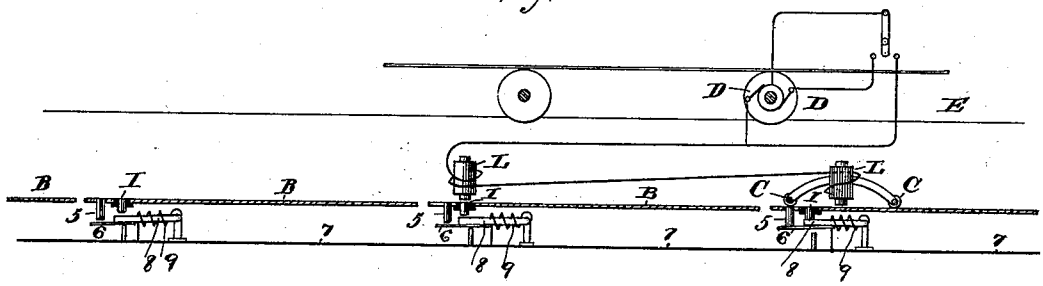
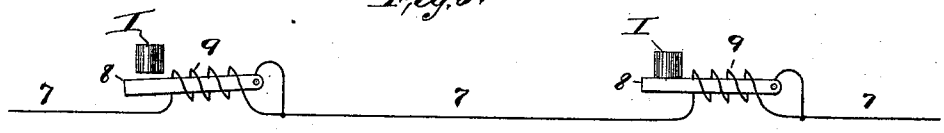


Fig. 3.



Attest
C. W. Benjamin
Wm. H. Capel.

Inventor:
John H. Guest
By H. G. Townsend
atty

(No Model.) 2 Sheets—Sheet 2.

J. H. GUEST.

SUPPLY SYSTEM FOR ELECTRIC RAILWAYS.

No. 537,197. Patented Apr. 9, 1895.

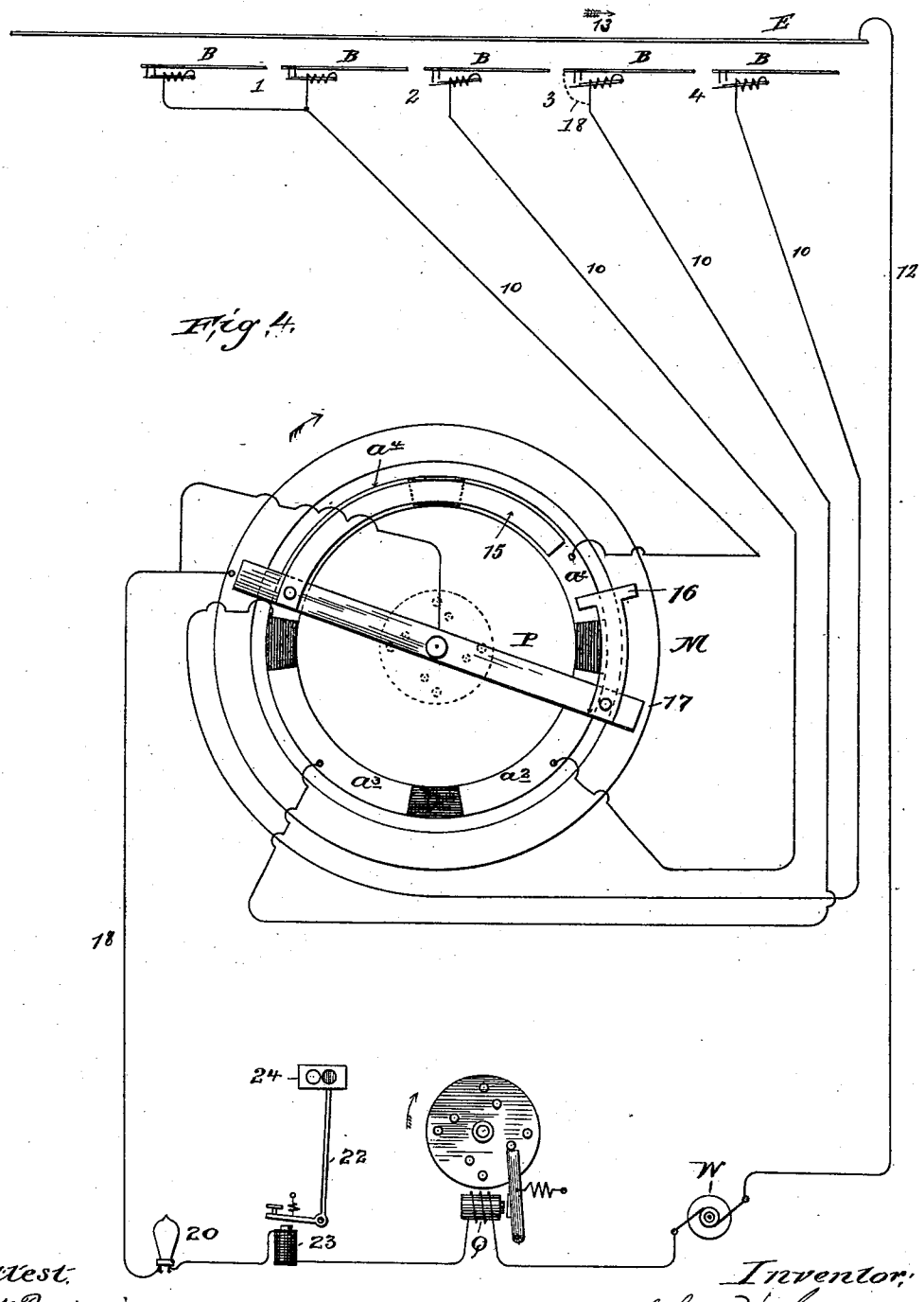


Fig. 4.

Witnesses:
C. W. Benjamin
Wm. H. Capel.

Inventor:
John H. Guest
By A. G. Tennant
Atty

UNITED STATES PATENT OFFICE.

JOHN H. GUEST, OF BOSTON, MASSACHUSETTS.

SUPPLY SYSTEM FOR ELECTRIC RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 537,197, dated April 9, 1895.

Application filed November 3, 1893. Serial No. 489,915. (No model.)

To all whom it may concern:

Be it known that I, JOHN H. GUEST, a citizen of the United States, and a resident of Boston, in the county of Suffolk and State of Massachusetts, have invented a certain new and useful Improvement in Electric Railways, of which the following is a specification.

My present invention relates more particularly to that class of electric railways in which the working contact or conductor from which the car takes up current is divided into separate sections or contacts that are automatically charged as the car reaches the section and discharged as the car leaves it by means of suitable electric switches that are normally open and when closed connect the said section or working conductor with a suitable supply wire or circuit leading from a proper source of energy.

My present invention consists in the combination with each switch, of an armature actuated by a magnet on the car so as to throw the switch and connect the working conductor to the supply line, and a polarizing electric coil in the circuit closed by said switch for holding the latter in position, as hereinafter described. The reversal of the switch so as to open circuit is accomplished by breaking the circuit of said coil and establishing a repulsive effect in any proper manner as the car leaves the section. One kind of device suitable for this purpose is hereinafter described. This part of my invention consists in making the collector preserve connection in passing from one section to another and in reversing the position of the switch after the collector makes connection with the corresponding section by some device carried by the car.

My invention consists further in the combination with a sectional working conductor, of a step by step switch for closing the connection to said sections in succession, and a controlling magnet or magnets for said switch operated by the power currents as the vehicle passes onto and off the sections. This part of my invention is an improvement in the direction of simplifying the system described in a prior application for patent filed by me July 6, 1893, Serial No. 479,742, wherein I have described the use of a generator independent of the power generator for operating the magnet controlling the switch.

My invention consists also in the combination of a sectional working conductor, a switch for each section adapted to close the circuit to said section as the car passes onto it and to break the connection as the car passes off, and an automatic step by step electric switch controlling the connections from the power generator to said sections whereby each car may be prevented from approaching a car ahead nearer than the distance covered by all the sections controlled by said step by step switch.

My invention consists also in the special combinations of apparatus more particularly specified in the claims.

In the accompanying drawings:—Figure 1, shows in side elevation and vertical section two adjoining sections of working conductor and individual automatic switches therefor constructed in accordance with my invention. Fig. 2, is a diagram of the circuits. Fig. 3, illustrates diagrammatically, a modification in the manner of keeping the magnets or armatures continuously charged or magnetized independently of the action of any of the devices on the vehicle. Fig. 4, is a diagram illustrating the manner of controlling the connections of a number of sections by an automatic rotary switch.

As will be well understood by electricians each section of working conductor may consist of a rail or section of wire engaged by a trolley or collecting device on the vehicle or each may consist of a block or contact of limited linear extent, the continuity of the cricuit on the vehicle being maintained by the use of a collector of sufficient linear extent to bridge the distance between said contacts. Whether the working conductor be made up of contacts or of bars, it may be alike termed a sectional working conductor.

I have herein illustrated my invention as carried out by the use of sectional working conductors each of which consists of the iron cover of a box or conduit containing the switch mechanism and the supply conductor or conductors. The cover of this box I prefer to

make of iron, in which event the switch devices are of special construction, as will be hereinafter described.

Referring to Fig. 1, A, indicates the box; B, the cover therefor, preferably screwed to the body of the box and provided with proper luting to prevent the entrance of moisture into the box A.

The cover B, is preferably flush with the surface of the road bed and is engaged by the current collecting device carried by the vehicle. The said collector may be of any kind but is herein shown consisting of a pair of wheels C, C, adapted to bridge the gap between the two sections B, B, of working conductor, and properly connected to the circuit on the car which passes through the driving electric motor D, or other translating device. The circuit is completed, as well understood in the art, by the rail E, on which the vehicle travels or in any other suitable manner. These devices so far as described, however, may be greatly varied without departing from my invention and are typical merely of any system of current supply to a vehicle wherein the working conductor or that from which the vehicle takes up the current is divided into sections.

Contained in the box A, is a switch adapted to close the connection between the section B, of working conductor and the circuit wire leading from the source of electric power. The contacts of said switch are indicated at 5, 6, the former 5, being connected with the section B, and being for the sake of convenience a pin or projection integral with or attached to the cover B, and projecting downwardly for engagement by a contact 6, that is by preference in the form of a spring and is in connection with the feeder or electric power wire 7, which latter may run through the sections of conduit which are covered by the part B. The contact 6, is carried by the arm or lever 8, of the switch, suitably pivoted as shown in the box or casing but insulated therefrom and connected by a tap-wire 9, with the wire 7. This spring 6, being carried by the switch 8, is by means of tap or branch 9, put in connection with the wire 7.

Connected with the switch 8, is a permanent magnet or a magnet which is continuously charged or magnetized independently of the operation of any device carried by the vehicle but, as shown, the whole switch lever itself is supposed to be permanently or continuously magnetized. By preference I make it a permanent steel magnet and insure the retention of the magnetism by the operation of electric current taken from any source. For convenience this source may be the power source for which purpose it is simply necessary to wind the steel bar with one or more turns of the branch wire or conductor 9. It is to be understood, however, that the action of the switch is not dependent upon the flow of current in the coil 9 and through devices on the car, the intention being that its magnetism shall be permanent or continuous and independent of any circuit over the car.

As indicated in Fig. 3, the magnetism of the bar 8, might be maintained by a coil indicated in the direct power wire 7, and the branch to the switch taken from said wire without passing around the bar. The office of this permanently or continuously magnetized switch is to hold the contacts 5, 6, closed after they have been once closed, until, by a positive repulsive action the switch is thrown into the opposite direction.

As will be seen after the switch has once been operated by any suitable means carried by the vehicle, the maintenance of it in circuit closing position is not dependent upon the operation of any device or devices carried by the vehicle or upon the continued closure of any circuit through devices carried by the vehicle.

To throw the switch into the opposite position so as to sever the section of sectional working conductor with the power wire, I employ some means operating by magnetic repulsion upon the switch.

I prefer to cause the switch to close circuit by the use of magnetism brought to bear by the vehicle as it passes along over the switch, but as will be understood the gist of my invention consists in the use of the permanently or continuously magnetized switch.

The bar 8, operates much as the armature of a polarized relay, being set into one position by magnetism of one polarity and restored to the opposite position by magnetism of the opposite polarity. The bar 8, operates in conjunction with a mass of soft iron indicated at I, which may be located in any proper position for engagement by the bar 8, but is preferably so located as to serve as the means for carrying the actuating magnetism to said bar from the exterior to the interior of the chamber in which the switch is located. This piece I, which, for convenience, I term an inductor, should be mounted in a plug K, of some non-magnetic material when the top of the casing or containing chamber is made of iron. This is done for the purpose of concentrating the magnetic effects of the magnet or other device carried by the vehicle upon the armature or switch as indicated, which cannot be done satisfactorily when the attempt is made to use the top of the cover itself as the intermediate inductor. Moreover, if the pin or inductor were not magnetically insulated from the iron constituting the cover of the box or the working conductor on which the collector travels, the armature, if drawn up against the cap or cover, could not be readily detached through repulsion.

The plug K, may be screwed into the opening in the iron cover, as shown, and the iron pin I, fixed therein in any proper manner.

Magnetism to first attract and then repel the switch or vice versa, so as to first close

and then open the connection, is provided upon an electro-magnet or magnets carried by the vehicle and indicated at L.

Where the sections are of very small length, the electro-magnets L, may be two legs of a horse-shoe magnet, one being north and the other south, but as will be obvious they might be entirely independent magnets one adapted to present a north and the other a south pole to the switches. The distance between the magnets L, is governed by the length of the sections, the parts being so proportioned or organized that as the car enters the section the first magnet will act on the armature 8, in a manner to draw it against the mass of iron I, where it will be held by its own magnetism, although the magnet L, producing such action may move away. The second magnet L, operates to produce a repulsive effect and actuate the switch positively in a direction to open the circuit as soon as connection is established with the next succeeding section of working conductor by the collector. The poles of the magnet move in close proximity to the cover B, and to the inductor I, and the collector is so arranged as to leave each section before the magnet operates on the switch to repel it and break the circuit. As will be seen, therefore, any sparking that takes place will of necessity take place between the working conductor and the current collector and none at the switch, since when the latter is opened by the repulsive action, the working conductor will be dead.

It will of course be understood that the distance between the two magnets L, is such that the switch of the section ahead will be operated to close connection before the switch of the section behind it is operated to break circuit.

The electro-magnets L, may be energized from any suitable source and for the sake of convenience I include them in the power circuit on the vehicle or in a branch of such power circuit as indicated in the diagram. It will be seen that by this organization as soon as the polarized switch establishes connection for a section of working conductor no accident that may occur on the car or in the power circuit connections will sever such connection until it may be severed by the positive action of the device on the vehicle.

The motor-man may make and break the circuit of his motor with impunity while the motor is over any section for the permanent or continuous magnetism of the switch will hold the connection for such section of working conductor with the power circuit. Moreover, should the main line connecting the contact with the source of power be broken thereby severing electrical communication between the car and power station, the car would be able to start again the instant the line is repaired because the permanent magnet would continue to preserve contact.

It will be understood that the conductor 7, may be a continuous conductor leading from the power source through the whole line of connected sections of boxing or conduit and a tap be taken from the said wire or conductor at the proper points to the several switches, or that each section may have a separate feeder wire or connection leading to the power source as desired. In practice it is desirable to run a number of sections of the working conductor from the same feeder 7.

When in the operation of the apparatus the spring 6, makes contact with the pin 5, the current which flows saturates the permanent magnet and causes the contact to be firm and lasting until opened by the positive repulsive action.

In the diagram Fig. 4, five sections of working conductor B, are shown, two of them being operated together as section 1. 10, indicates the branch or feed wires leading from said sections to a rotary switch indicated at M. 12, is the return wire and W, is an electric power generator for operating the cars traveling over the sections B. Switch M, is a step by step switch, the segments of which are connected individually to the wires 10, and serve to close connection between the power generator W, and the feeders or wires 10, in succession and in the order in which the sections B, are numbered, the direction of travel of the vehicle being that indicated by the arrow 13. The segments of the switch corresponding to the several sections of working conductor are indicated at a', a^2, a^3, a^4. 15, is a switch spring riding over the said segments and attached to the rotary arm P, which is controlled by the action of any proper escapement device governed by an electro-magnet Q. The escapement device here shown is an ordinary pin escapement consisting of a disk attached to the spindle of the arm P, and carrying two series of pins that are engaged in turn and stopped by the armature lever of the electro-magnet Q. 16, is a switch spring carried by the arm P, but insulated therefrom and adapted to continually bridge the space between the segments of the switch and a continuous ring or contact 17. This ring is connected to the power generator as shown in the diagram as is also the spring 15, through connection of the spindle of the arm P, with the wire 18, leading to the generator. When these devices are employed it is to be understood that in the movement of the car and current collector from one section to the other, a temporary interruption of the main circuit takes place. This is readily provided for when the actuating magnets on the car are employed, by a proper relative arrangement of the collector and the magnets on the car which actuate the switch to connect the section so that said magnet shall not reach the spot over the armature until after the collector has left the section behind.

The parts being proportioned and organized as shown, the operation would be as follows: In the position shown it is supposed that the car is on the sections 1, of working con-

ductor and is taking current from said sections, magnet Q, being therefore energized by the power current flowing from the generator W, and holding the armature lever in the position indicated. When the connection is broken with the feeder wire or circuit 10, by the car leaving the section 1, the magnet Q, would be de-energized allowing the escapement to move a short step sufficient to carry the spring 16, off the section a', and onto section a^3, but leaving spring 15, on section a'. As soon as spring 16, however, finds section a^3, it will complete the connection over the branch 10, to the section 2, of working conductor and as the collector devices on the car are now in connection with such section either by means of the devices already described or by any other device known in the art, the magnet will be immediately de-energized allowing the escapement to rotate a long step and to carry the spring 15, onto section a^3, and also bring the spring 16, forward so that both springs will now assume on section a^3, the same relative position with regard to said sections that they have upon section a', as shown in the drawings. The magnet Q, will continue to be energized and the switch to be held in proper position on section a^3, until the motor passes off the section 2, of working conductor, when the operation will be repeated. This action continues as the motor travels along until section 4, is left. When the motor leaves section 4, and the connection 10, is broken at the working conductor, the magnet Q, allows its armature to drop back and shift the spring 16, onto segment a', of the commutator, so that when the following motor completes the connection, the magnet will be energized and the switch will be allowed to move into the position shown in the drawings.

It will be obvious that the switch M, operates as a block switch which will prevent any motor following that moving over the sections B, from obtaining current from section 1, until the motor ahead has moved off section 4, and that the distance which can be maintained on any road between two motor cars can be determined by the number of sections employed in the switch M.

It will be understood that the switch M, is applicable to systems wherein the connection of each section of working conductor B, with the supply wire or branch 10, is completed as the car moves onto the section by means other than those heretofore described.

It will also be understood that this switch M, might be used in those systems wherein each section of working conductor is not provided with any automatic switch appliance but is permanently attached to the feeder wire or branch 10, as indicated by the dotted lines 18.

To insure still further the prevention of rear end collisions on electric railway systems employing my invention, I propose to employ in connection with each series of sections B, controlled by any switch M, a proper visual danger signal. This visual or danger signal is operated by the current employed in actuating the switch M, and may be either a visual or audible signal. Such a signal I have indicated in the circuit of the power generator K, as consisting of an electric lamp 20, for use by night and an ordinary semaphore signal 22, the electro-magnet of which indicated at 23, actuates a proper disk to bring the same in front of an opening 24, in a shield, as well understood in the art of railroad signaling. As will be seen, so long as the switch M, is in operation for the sections of working conductor B, connected to it, the magnet 23, will be in connection or the lamp 20, will be lighted. These visual signals are located in any proper position along the line of track as circumstances may require and as well understood in the art.

What I claim as my invention is—

1. The combination in an electric railway system, of a sectional working contact or conductor, an electric switch for each section, an actuating magnet or magnets carried by a vehicle, an armature connected to each switch whereby the switch may be actuated by a magnet on the car as the latter enters a section, a polarizing coil for said armature in the circuit closed by the operation of the switch, and a mass of iron for holding the switch armature in circuit closing position after the influence of the actuating magnet has ceased.

2. The combination with the sections of working conductor, of polarized switches connecting each with a supply wire or circuit, means carried by the vehicle for acting on said switches first with magnetism of one polarity and then with magnetism of the opposite polarity, and a magnetizing coil in a circuit closed by the switch, and a mass of iron for holding the switch armature while magnetized by said coil, in the position into which it is set during the interval of action.

3. The combination in an electric railway system, of a circuit closer and breaker contained in a sealed chamber or conduit, a conducting cover therefor with which said circuit closer makes and breaks connection, an actuating magnet carried by the vehicle, an armature therefor within the chamber and connected with the circuit closer, and an intermediate inductor extending through the wall or cover for carrying the actuating magnetism from the exterior to the interior of the containing chamber.

4. The combination in an electric railway system, of a sectional working conductor, a rotary switch having segments or contacts controlling connections to said sections, a step-by-step mechanism for said switch, and an electro-magnet controlling said switch and located in the power circuit in series with the car motor as contradistinguished from the circuit of a supplemental generator.

5. The combination, substantially as described, of a number of sections of working conductor, a rotary switch controlling the connections thereof with a power generator, a

step-by-step mechanism for said switch, and a controlling magnet having a vibratory armature connected to said step-by-step mechanism, said magnet being common to a number of sections and being in the power circuit in series with the car motor as contradistinguished from the circuit of a supplemental generator.

6. The combination, substantially as described, in an electric railway system, of a number of sections of working conductor, an automatic rotary switch for said sections, a controlling magnet therefor, and an electric visual danger signal in the circuit of said switch.

7. The combination, substantially as described, of a number of sections of working conductor, an automatic block switch controlling the connections thereof with a power generator, and an electric railway signal in a circuit common to said sections, as and for the purpose described.

8. In an electric railway system having its working conductor divided into normally disconnected or insulated sections, the combination with the switch contained in a sealed chamber, an actuating magnet acting momentarily thereon as the car enters a section, a soft iron inductor I, interposed between the magnet on the car and the switch armature therefor on the road bed and magnetically insulated from the iron wall or cover of the chamber through which it passes, and an operating armature for the switch held by magnetic attraction between said inductor and armature in circuit closing position after the passage of the magnet beyond the position of influence.

9. In an electric railway system, the combination with the armature on the road-bed and the inductor extending through the casing inclosing the armature, of a spring extending from said armature and adapted to close circuit when the armature is drawn up by said inductor.

Signed at Boston, in the county of Suffolk and State of Massachusetts, this 1st day of November, A. D. 1893.

JOHN H. GUEST.

Witnesses:
HOMER ALBERS,
HENRY A. WYMAN.