

(No Model.)

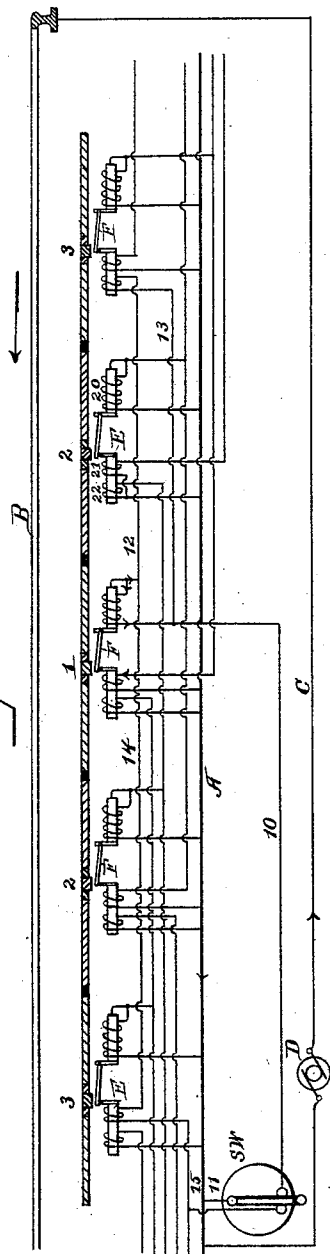
2 Sheets—Sheet 1.

J. H. GUEST.
CLOSED CONDUIT ELECTRIC RAILWAY.

No. 537,200.

Patented Apr. 9, 1895.

FIG-1-



ATTEST:

T. F. Conroy
Wm. T. Capel

FIG-2-

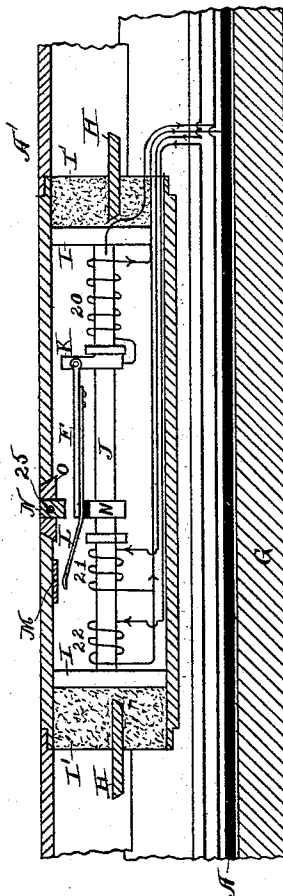
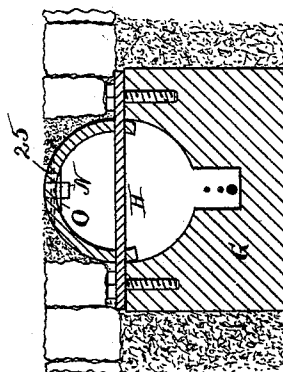


FIG-3-



INVENTOR:

John H. Guest
By T. L. Townsend
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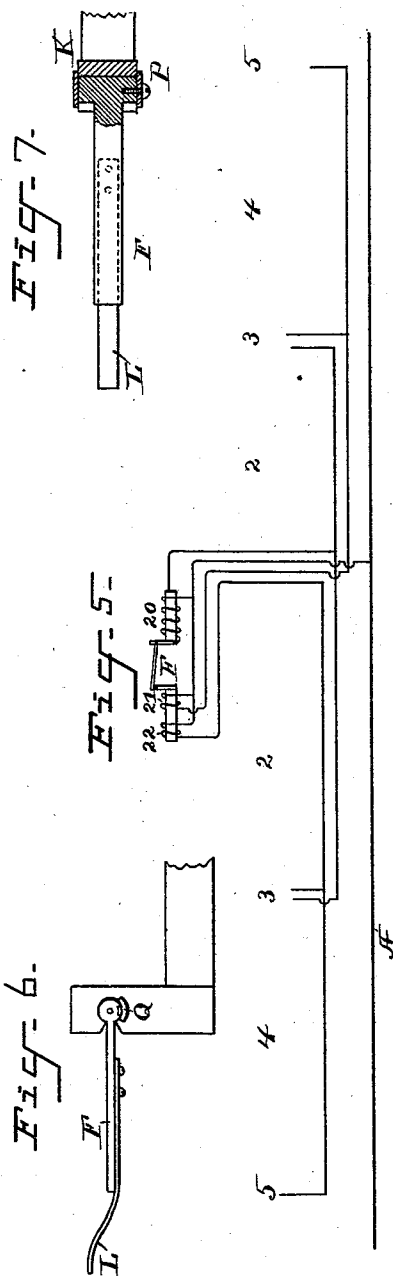
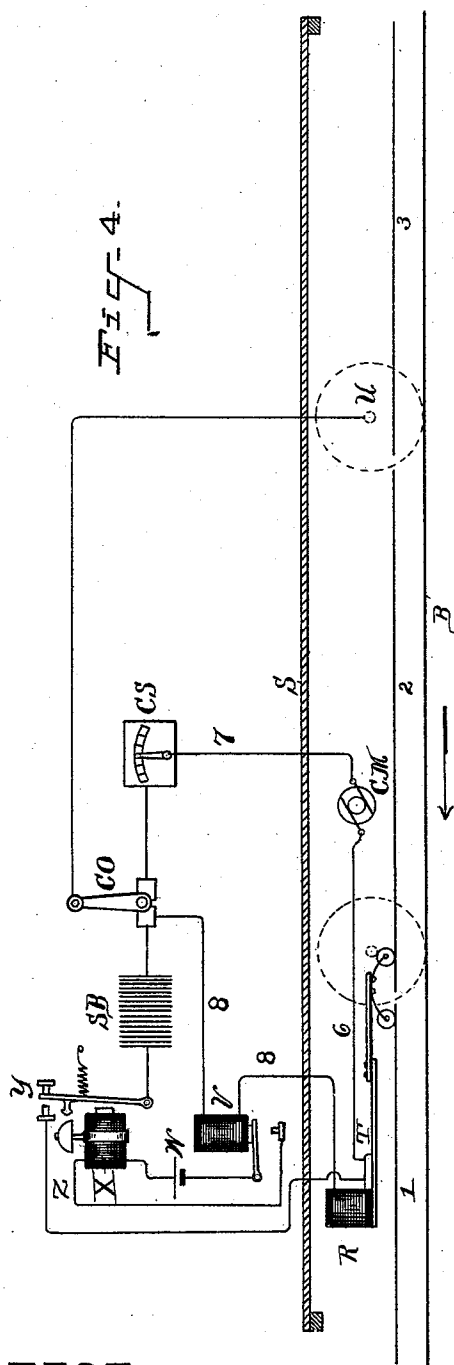
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2 Sheets—Sheet 2.

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ATTEST:
S. F. Conroy,
W. H. Capel.

INVENTOR:
John H. Guest
By H. C. Townsend
Attorney.

UNITED STATES PATENT OFFICE.

JOHN H. GUEST, OF BOSTON, MASSACHUSETTS.

CLOSED-CONDUIT ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 537,200, dated April 9, 1895.

Application filed April 10, 1894. Serial No. 507,018. (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 invention relates to an electric railway system wherein the working conductor from which the car takes up current is divided into separate sections that are automatically charged as the car reaches a 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 of working conductor with a suitable supply wire or circuit leading from a proper source of energy.

My invention relates more particularly to such systems when the working conductor is placed in the roadway of a street and is engaged by a trolley or collector carried by the vehicle although, in some of its particulars, my invention is applicable to other arrangements of the working conductor.

My invention also relates to railway systems wherein the automatic switches for connecting the sections of the working conductor with the supply wire are operated by means of an electro-magnet carried by the car which influences an armature on the road bed.

In illustrating this part of my invention I have shown it as carried out in connection with a system of magnetic switches having the same general plan of connection and operation as described in my prior application for patent filed February 20, 1894, Serial No. 500,858.

One of the principal objects of my invention is to provide a simple and cheap construction of conduit, working conductors and switches readily capable of repair and free from the disturbing effects of moisture.

A further object is to provide a strong and durable construction adapted to withstand the effects of heavy traffic.

One part of my invention consists in mounting the automatic switches that connect the sections of the working conductor with the supply wire in a metal tube, preferably of iron,

whose surface forms a part of the working conductor and in which the switches and their operating devices are sealed the electric connections for the switches being carried out through the sealed end for connection with the wires of the system.

My invention consists further of a novel construction wherein a stringer of wood or suitable insulating material is led along the track between the rails and is grooved in its upper surface to contain the line wire and other conductors, and the working conductor is composed of a cover plate for said stringer formed in part of the sections of sealed tubing and in part of covers secured upon the top surface of the stringer and in electrical connection with the sections of tubing.

My invention relates further to the means of energizing the electro-magnet on the vehicle which influences the switches on the road bed and consists essentially in the combination with an electro-magnet energized from the circuit taken up by the vehicle, of an auxiliary generator on the vehicle and means for automatically closing the circuit thereof through the magnet when the current taken up by the vehicle fails.

My invention consists also in other details of construction and combinations of parts as hereinafter more particularly described and then specified in the claims.

In the accompanying drawings, Figure 1 is a diagrammatic representation of my system showing five successive sections with the magnetic switches therefor and the train stopping switch. Fig. 2 represents a longitudinal vertical section through a portion of the conduit illustrating one of the magnetic switches and the circuits connected thereto. Fig. 3 is a transverse section of the conduit showing its relation to the surface of the street and the manner of constructing the same. Fig. 4 is a diagrammatic representation of the apparatus upon the train and its relation to the sectional conductor. Fig. 5 is a detail diagram of the connections of a single switch magnet. Fig. 6 represents a side elevation of the circuit closer and its support as used in my electric circuit closing switches. Fig. 7 is a partially sectioned plan thereof showing the

manner of hinging or pivoting the armature of said circuit closer to the polar extension of one of the magnets.

A, indicates the main conductor, for which the rail B, the train circuit, and conductor C, act as the return; the generator being indicated at D. At intervals of about ten feet or one third the length of the car are located the switches E, which, when operated, shall serve to convey current to the sections of the working conductor A'. These switches consist of an electro-magnet 20, to whose polar extension is pivoted the circuit closer F, of soft iron or steel. The opposite or free end of this circuit closer is arranged over the pole for the other magnet of the switch around which pass coils 21, 22. An actuating magnet upon the car attracts the circuit closing armature F, to the connection to the sections of the working conductor so that circuit may be made between the rail B, and the main conductor A, through the car motor. The electro-magnet 20, when excited polarizes the armature F, and assists in keeping it in circuit closing position. The other electro-magnet having coils 21, 22, acts with proper polarity on the opposite end of the armature F, to draw it down when it is charged by current in the coils 21, 22.

The conduit for the switches and conductors consists mainly of a metal tube or cap which is divided into insulated sections and serves as the working conductor A', and is supported upon a suitable stringer as G, of wood or other insulating material, located in the road bed. This stringer is grooved as shown in Figs. 2 and 3, for the reception of the conductors and the sections of the cap. This cap may be secured to the stringer by cross pieces H, which pass through perforations in the cap and are bolted to said stringer. About the middle of each section is a short length of iron tube or pipe which need not be more than six inches in length or might be shorter or longer and in this tube the parts of the circuit closing switch are located, and sealed as seen in Fig. 2. Through the end of this tube pass the conductors for attachment beneath the cover A', to the wires or conductors in the stringer. At the junction of each cap A', and section of tube or pipe, the cross piece passes through both as indicated in Fig. 2, so as to interlock or dovetail them together, thus securing good electrical and mechanical continuity at the joint. The caps A', might be held down upon the stringer at other points by ears or similar devices instead of pieces extending through the cap from side to side.

Each magnet may be sustained by securing its cores to plugs I, inserted in the ends of the tubes, said cores being connected at their adjacent ends by a rod of brass J. The ends of the tubes then are sealed with any suitable cement I'.

To the polar extension K, of the magnet 20, is pivoted the armature F, of the circuit closer,

the opposite end of said circuit closer resting normally upon the polar extension of the opposite magnet, being separated therefrom by non-magnetic material. This circuit closer F, which is of iron or steel, preferably the latter so as to form an armature for the electro-magnet R, on the car, may have connected thereto a spring contact L, which shall engage directly with the tube or with a contact plate M, therein. By this means a rubbing contact is provided which serves as a safeguard in case parts F and N, should, on account of rust, fail to make perfect contact. Through the said tube is passed a soft iron plug N, surrounded by a brass bushing O. This plug serves to convey magnetic influence from the magnet on the train to the circuit closer F. The circuit closing armature F, is mounted in the polar extension K, being socketed therein, as shown in Figs. 6 and 7, by a head formed on the circuit closer, one end of which head is provided with a flange while the other end is constructed to receive a washer and screw P, for retaining it in the projection K. A slit at one side of the socket in the extension K, provides for the insertion and play of the circuit closer armature.

To insure good electric connection between the circuit closer armature and the polar extension when the circuit is through said pole, I insert in the head of the circuit closer armature a strip of brass or other good conductor and in the socket for said head another strip of brass the surfaces of which strips shall be always in contact as shown at O, in Fig. 6.

The magnet for attracting the circuit closer F, may be carried on any part of the car which shall present it properly to the working conductor, but it is preferably mounted on such part of the truck as has but slight variation in its proximity to the surface of the street. This magnet is represented in Fig. 4, at R, wherein the car is symbolized by the sill S, and the wheels shown in dotted lines. The magnet is provided with a polar extension T, for the purpose of prolonging the effect upon the circuit closer when the car is moving at considerable speed. I prefer to make the magnet R, carried on the car and the shoe of steel so that they will be permanently magnetized and not, therefore, wholly dependent on the coil R, for their magnetism which actuates the circuit closer on the road bed. It will be seen, therefore, that in case the car should at any time be over a section that is not alive, so that there will be no current in the coils of R, the permanent magnetism will serve as a means for operating the circuit closer in the conduit and making connection to such section so that the car may proceed. This permanent magnetism would also serve to operate the circuit closer in case the storage battery should fail. Under some circumstances it might be possible to employ a permanent magnet alone without the coil,

but it is desirable to employ the coil because the latter will serve to keep up the permanent magnetism which would otherwise gradually fail with use.

5 I have shown the trolley or collector as connected to the end of the polar extension T, and consisting of two wheels stationed apart so as to span the insulation between the sections of the working conductor. This collector
10 may obviously be of any other form and supported in any other convenient manner.

The car motor is represented at C, M, and is connected to the polar extension T, by conductor 6, which conductor may of course be
15 connected in any other manner to the trolley or current collector. From the motor a connection is made by conductor 7, through the usual controlling switch or rheostat indicated at C, S, and a cut-out switch C, O, to the return by way of the wheel and axle U.

The electro-magnet R, is normally energized by a portion of the main current shunted therethrough over the conductor 8, but might be otherwise connected to the circuit on the
25 car so as to be charged by current taken by the car from the section of working conductor whose switch is closed. To provide for energizing said magnet in starting a secondary battery S, B, is placed upon the car.

30 In the circuit 8, is located a magnet V, which controls the circuit closer of a local circuit W, which circuit is normally broken, the circuit closer being held up by the magnet V, so long as the magnet R, is charged from the main line circuit. As soon as the main line circuit is interrupted, the magnet V, will drop its armature thereby closing circuit W. In circuit W,
35 is a magnet X, which operates upon a circuit closer Y, for the secondary battery S, B, so that the closing of circuit W, operates to close the circuit of the secondary battery through the magnet R. To warn the motor-man that such a change has been made, a bell Z, may be provided which shall be struck by a hammer
40 actuated by the circuit closer Y.

The operation of the car upon my system will now be described. It is intended as shown in Figs. 1 and 4, that a car shall span three sections of the working conductor and cover
50 all the sections that are alive at any one time, the car as it progresses cutting in successive sections as they pass under the car and cutting out those that are about to emerge from under the car. Supposing the car to be at
55 section 1, and the armature F, attracted, thereby making contact with the plug N, and the spring thereon with the tube, the circuit will be formed as follows:—From the generator D, by conductor C, rail B, wheel U,
60 switches C, O, and C, S, conductor 7, motor C, M, conductor 6, the collector section 1, contact F, coil 20, conductor 10, switch S, W, conductor 11, to the main circuit A, and to the generator. This will magnetize the circuit
65 closer F, which is in reality a polar extension of magnet 20, and cause it to retain contact

with plug N, so long as a current flows through coil 20.

The purpose as explained in my prior application, filed November 4, 1893, Serial No. 489,915, in using a non magnetic bushing for the plug is to concentrate the effects of the magnet R, upon the plug, instead of allowing them to be dissipated in the iron of the cover.

I find in practice that owing to the limited
75 magnetic capacity of the plug itself, the attraction between itself and the armature F, is not always sufficient to retain it strongly after the magnet on the car has passed along so far as not to influence the armature. To
80 overcome this difficulty I provide the plug with a magnetic extension of limited magnetic capacity connecting it with the cover as indicated by the dotted lines at 25, Figs. 1 and 2. This may be made by boring through
85 the iron of the cover and the metal of the bushing into the plug, and packing the bore, with iron filings or inserting an iron pin. By this means the magnetic mass of the plug is virtually increased so that the armature will
90 adhere more firmly. This pin also provides a path for the current in case there should be oxidization between the brushes and the iron in which it is set. It will be noticed that section 2, is still alive for the trolley is still upon it
95 but section 3, which is about to emerge from under the car is cut out as soon as the circuit is closed through the switch of section 1, and as follows:—A circuit is formed which branches from the core of magnet 20, and extends rear-
100 wardly (the train being supposed to travel from right to left as indicated by the arrow), by a conductor 12, to coil 22, of the switch at section 3, whence it returns by conductors 13, 10, 11 and A, to the generator. Another branch
105 of this circuit extends forward of section 1, by conductor 14, to coil 21, of advance section 3, and thence by conductors 15, 11 and A, back to the generator. Now as the train progresses and enters onto section 2, the circuit closer F,
110 of that section will be attracted and complete the circuit as before from rail B, to conductor A, which shall act to assist in retaining the circuit closer F, in contact so long as current flows through coil 20, of said section. Branch
115 circuits to the rear and to the front will also be formed, the one to the rear extending to coil 22, of section 2, and the other to coil 21, of section in advance of section 3. The circuit set up in the magnet of the section in the rear acts
120 to withdraw the circuit closer from its contact with the working conductor and that set up in the magnet in the section in front insures the withdrawal of any circuit closer that may by mischance have been left in contact by a
125 train in advance. The switch S, W, shown in Fig. 1, is provided for the purpose of stopping a train at any desired point as, for instance, at section 1, which may be a section at some certain distance from a station or some certain
130 distance from a crossing or draw-bridge. When this switch is open the circuit through

coil 20, will be broken, also circuit through coil 21, of section 3, in advance and circuit through coil 22, of section 3, in the rear. As a car runs upon section 1, after circuit thereto has been broken current will cease to flow through shunt 8, on the car as seen in Fig. 4, which will close the local circuit and also the circuit through the secondary battery. At the same time notice will be given to the motor-man that the main circuit has been broken warning him to bring his train to a standstill. This notice may be given by any other form of signal as by an annunciator drop or electric light.

The circuit closer controlled by magnet V, is so constructed that when once released by the magnet it cannot be again attracted but must be lifted by hand. This is to allow for retaining the circuit of the secondary battery closed so that current therefrom may be used to start the car and to energize magnet B, the current for these purposes passing from said battery through switches C, O, and C, S, conductor 7, motor C, M, conductor 6, and circuit closer Y, and also from the battery through switch C, O, conductor 8, magnet R, and circuit closer Y, to the battery. When the car has advanced a sufficient distance to enable the magnet R, to pick up a circuit closer F, then the armature of magnet V, may be lifted which will break the local circuit and consequently the circuit of the secondary battery. The secondary battery may also be charged from the line circuit by stopping the train, throwing switch C, O, to the left and closing circuit closer Y. The current would then flow from D, over C, B, U, C O, through S B, circuit closer Y, T, the trolley, conductor A', and one of the switches, conductor A and back to D.

With the conduit constructed as described thorough protection is given to the switches and to the conductors. The conductors in the groove of stringer G, may also be further protected by embedding them in tar, cement or the like.

Each of the tubular sections which contain the electric switches may be secured in any convenient manner to the remaining portions of a section of the working conductor, as by a lap joint as shown or by a screw joint.

Many variations may be made in the construction and combinations of parts without departing from the principle of my invention.

In my prior application before referred to I have described the switches as operated by magnets on the car to close circuit and as reversed in position by the operation of another electro-magnet which is in the circuit closed by the switch of another section to the front or the rear and this general system I do not, therefore, herein claim.

It will be readily understood that my invention herein described is applicable not only to that special system but to many others wherein the switches are operated automatically as the car progresses whether by the magnet on the car or by other means.

What I claim as my invention is—

1. In an electric railway, a section of working conductor composed of a sealed iron tube containing the switch for connecting the same with a source of supply, and iron cover plates for the conduit containing the wires of the system, said cover plates being attached to said tube, as and for the purpose described.

2. In an electric railway system, a section of iron tubing sealed at its ends and containing a switch controlling the connection of said tubing with a supply source, said tube being arranged parallel to the track and forming a part of the working conductor.

3. In an electric railway system, the combination of the stringer of wood or other suitable insulating material open at the top and holding the wires or conductors for the system, sealed metal receptacles mounted thereon flush with the road-way, and containing the automatic switches, and detachable metal cover plates for the stringer in electric connection with the said sealed receptacle.

4. The combination of the stringer of insulating material holding the conductors and filled in with insulating material, the metal tubes resting on said stringer and containing the magnetic switches, electric connections from said switches passing through the cemented ends of said tubes for connection with the wires in the stringer, and a metal cover plate attached to the stringer over the connecting points.

5. The combination with the stringer and the metal tube containing the switch, of the cover plate and the cross piece dovetailing the cover and tube together and fastening them to the stringer.

6. The soft iron inductor mounted in a non-magnetic metal bushing in an iron cover plate, and provided with a magnetic extension connecting it with said iron cover, as and for the purpose described.

7. In an electric railway system, the section of sealed metal tube containing two electro-magnets joined by a non-magnetic rod, and a switch armature mounted on the pole of one magnet and having its free end over the pole of the other.

8. The combination with the switch actuating electro-magnet on the car charged by current taken up by the car through said switch, of a supplemental generator on the car, and an automatic circuit controller responsive to interruption in the normal flow of the current through said switch actuating electro-magnet for completing the circuit of the supplemental generator through the same.

9. In an electric railway system, the combination with a section of working conductor and the magnetic switch for closing the connections therefor, of an actuating magnet on the car having a rearward polar extension, as and for the purpose described.

10. In an electric railway system having a sectional working conductor normally discon-

5 nected from the source of supply, automatic switches for connecting the same as the car travels, an audible alarm or signal on the car and independent of the car motor, and means for operating the same automatically on failure of the current on the car from any section of working conductor.

11. The combination with the iron or steel armature lever F, socketed in the core or po-

lar extension of the magnet, of the metal insertion, as and for the purpose described.

Signed at Boston, in the county of Suffolk and State of Massachusetts, this 5th day of April, A. D. 1894.

JOHN H. GUEST.

Witnesses:

HOMER ALBERS,
CHAS. O. ENGSTROM.