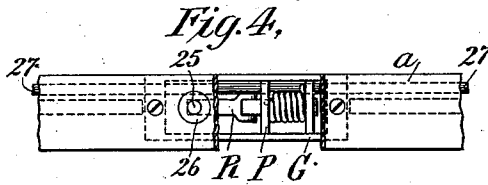
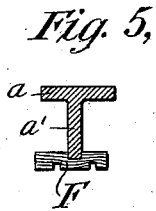
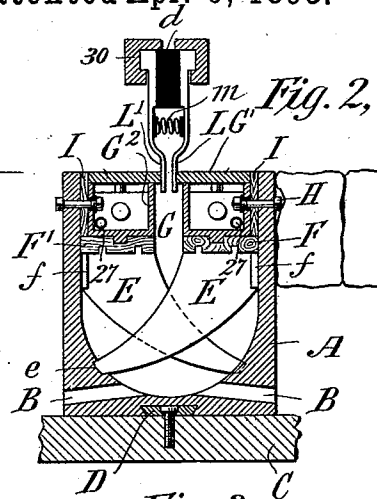
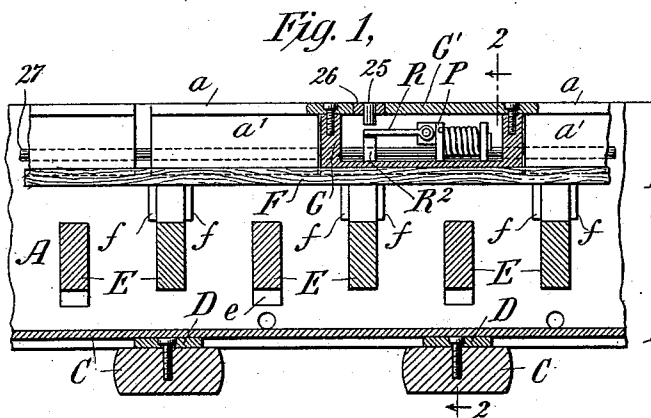


(No Model.)

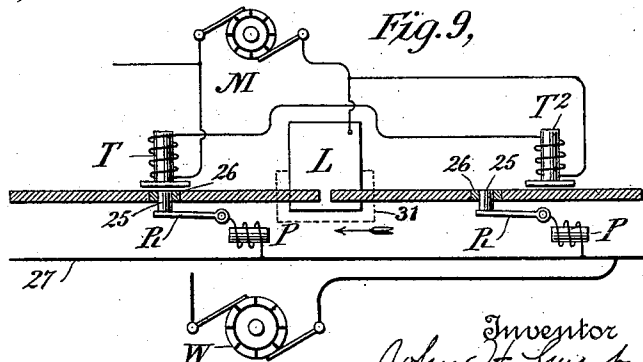
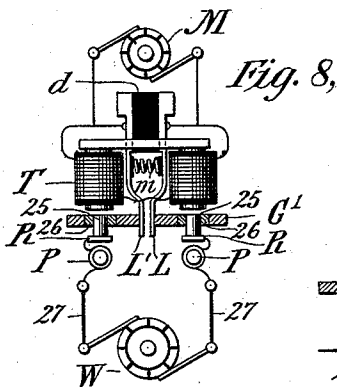
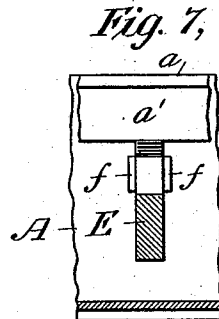
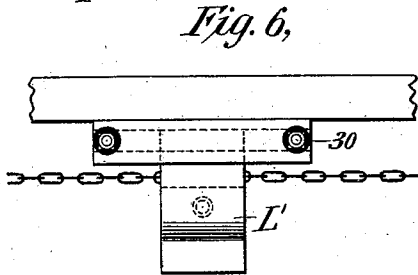
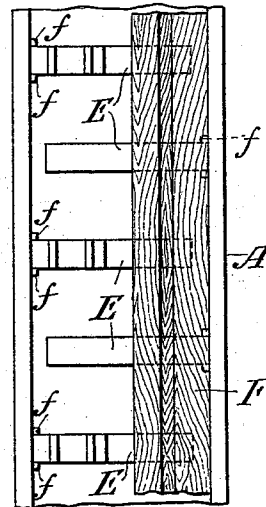
J. H. GUEST.  
CONDUIT ELECTRIC RAILWAY.

No. 537,195.

Patented Apr. 9, 1895.



*Fig. 3,*



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Inventor  
John H. Guest.  
By his Attorney  
H. B. Townsend

# UNITED STATES PATENT OFFICE.

JOHN H. GUEST, OF BOSTON, MASSACHUSETTS.

## CONDUIT ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 537,195, dated April 9, 1895.

Application filed April 14, 1894. Serial No. 508,380. (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 electric railway systems in which a conduit in the roadway beneath the car is employed for holding the electric conductors which supply current to the car.

The invention is designed more particularly as an improvement on the slotted conduit system heretofore proposed and does away with the difficulties arising from dirt, moisture, short circuiting, inaccessibility, &c., met with in such systems.

In carrying out my invention I propose to employ a sectional working conductor from which the car shall take up current, the said sections being normally insulated from one another and from a suitable supply conductor or line wire, and provided with automatic switches whereby each section may be automatically charged as the car reaches a section, and discharged as the car leaves it.

In describing my present invention I shall, for the sake of illustration, assume that the said switches are of the kind wherein an armature is connected with the switch for operating the same and a magnet on the car actuates the armature to cause the switch to close connection between the sections of working conductor and the supply wire, the armature being returned to normal position by the repulsive action of another magnet on the car or in the conduit in a circuit closed from another section. I wish it to be understood, however, that I do not limit myself to any particular style of automatic switch or manner of operating the same, as my invention is mainly in the details of the conduit itself, the manner of mounting the switch boxes in said conduit, the construction of the sections of working conductor, and other features designed to simplify and cheapen the system, as well as to render it easy of repair and safe and durable in use.

In the accompanying drawings, Figure 1 is a longitudinal vertical section through the conduit on the line of the slot, the switch box

being shown in section at one side of said line. Fig. 2 is a cross section through the conduit on the line 2, 2, Fig. 1. Fig. 3 is a plan of a portion of the conduit with the switch boxes removed. Fig. 4 is a plan of a portion of one of the working conductors a part of the plate constituting the conductor being broken away to show the interior of the switch box. Fig. 5 is a vertical section through an extension of the cover plate for said box. Fig. 6 shows a side elevation of a manner of mounting the plow or collector to permit it to be adjusted longitudinally of the car. Fig. 7 illustrates a modification of the invention. Figs. 8 and 9 are diagrams of the apparatus.

A, is the conduit proper formed in sections of any desired length and made of iron or other desired material, and open at its top to allow access to the contained parts for repair, or for entrance of the plow or collector which is carried by the car and makes connection with the sections of working conductor.

The conduit A, is preferably provided with drainage outlets B, and may also be provided at suitable intervals with pits or catch basins below the level of its bottom into which street dirt accumulating in it could be swept.

C, is the ordinary railroad tie or sleeper to the top of which is fastened an iron key piece D, that enters a groove in the bottom of the conduit and keys or dovetails the conduit down upon the sleeper and keeps it in position. The keys D, may be of any desired length longitudinally of the conduit but the groove in the bottom of A, extends the whole length, and the sections of conduit A, are put into position by driving or sliding each length into position against the section already laid.

E, E, indicate braces applied at intervals to the inside of the conduit to keep its sides spread against compression. Each brace is adapted to be dropped into place and to be withdrawn at pleasure without screws, bolts or other fastening devices. For this purpose its lower end or heel is made to fit into a notch e, in the side of the conduit near the bottom, while its opposite or upper end is squared to fit against the opposite side when lowered into position after insertion of the lower end into the notch e. Preferably lugs f, are formed inside of the conduit between which

the upper end of the brace is received to hold it upright. The tops of the braces, resting in position at an angle, are near their upper ends properly formed to receive and hold in place at the side of the conduit longitudinal stringers F, preferably of insulating material, forming a seat or shelf for the electric conductors and the switch boxes G. The stringers may be of wood treated for insulation and against decay and may be held against lateral shifting on the braces by a tongue and groove connection therewith as shown. The boxes may be similarly held by a tongue and groove connection with the stringer, as shown. At intervals the position of the upper ends of the braces is reversed to constitute a more uniform bracing, as well as to provide means for supporting similar stringers F', on the opposite side of the conduit, wherein to mount, if desired, the switch boxes and conductor for an electric return, independent of any return through the rails of the railway or other exterior conductor. It will be understood that as the office of the stringer is mainly to insulate the boxes and other parts supported on the braces from said braces, said stringer might be made in pieces or in very short lengths or might even consist of insulating blocks approximately as wide as the braces, as indicated in Fig. 7.

The boxes G, which are preferably of metal may also be fastened against the side of the conduit, as indicated, by suitable bolts H, which pass through the side of the conduit and the side of the box, as indicated, being insulated from the latter by proper material when the said box is of metal.

I, indicates another stringer preferably of wood, or other suitable material, and interposed between the side of the box and the side of the conduit, as shown, and preferably rising to the top of the cover plate G', for the box so as to insulate the latter as well as the box itself from the side of the conduit.

The cover plate G', is fastened down upon the box G, by suitable screws or bolts, as shown, and proper packing may be interposed to make the interior air and moisture proof. The cover G', is provided with longitudinal extension  $\alpha$ , as shown, formed integral with said cover G', and constituting with said cover a section of working conductor that, by the mechanism within the box, is placed in electrical connection with the supply conductor, or disconnected therefrom automatically by any suitable means. Each extension may have a foot  $\alpha'$ , supported upon the brace pieces or the stringer carried by the latter. The side edge of the cover G', and its extensions rest against the stringer I, and is held firmly against it by means of the bolt H, so that no moisture can enter the conduit at this point. The opposite edge of the cover forms the working face of the working conductor against which the collector L, carried by the car and entering the slot of the conduit, rubs.

The box and its cover are flush with the top

of the conduit and constitute a part of the cover thereof, as clearly indicated in the drawings, and the opening between the edge of the cover and the plate at the opposite side of the conduit forms the slot into which may enter the plow or collector.

The length of each section of working conductor will depend upon the nature of the switch system employed and will be governed by the circumstances of each particular case.

When it is desired to provide a return independent of the car rails, I provide a similar system of switch boxes at the opposite edge of the conduit, as clearly indicated in the drawings, which are similarly supported to those already described and lettered. The second set of switch boxes is indicated by the letter G<sup>2</sup>, and the edge of the cover thereof may be engaged by the proper collector in the same manner as the cover of the boxes G.

The collector, as indicated in Fig. 2, may consist simply of two plates L, L', fastened together, but insulated from one another by insulation indicated at  $d$ , and provided near their bottom end with a spring  $m$ , tending to force them apart and into engagement with the working conductor. The ends of the spring  $m$ , are insulated from said collectors by insulation as shown.

The automatic switches within the boxes may be actuated as follows:—P, is an electro-magnet suitably mounted within the box G, and R, is an armature for a magnet on the car or vehicle. This armature is preferably of steel and permanently magnetized but is mounted in an extension of the core for electro-magnet P, so as to be magnetized thereby. The free end of the armature R, normally rests over a piece of soft iron R<sup>2</sup>, being magnetically insulated therefrom, as shown, this piece of iron serving to retain the armature R, in open circuit position. When the armature is drawn up by a magnet on the vehicle it makes connection with a contact plug or piece 25, in the cover of G', and thereby places the latter in electrical connection with a supply conductor 27, which is connected with the core of the electro-magnet R, as indicated in the diagram, so that section G' becomes alive. The plug 25, is preferably of soft iron whereby the magnetism of the car magnet may be carried into the box, and it is set in a bushing of brass 26, or other non-magnetic metal to prevent the dissipation of the magnetism into the iron cover. Electric connection with the parts within the box is made by wires running through the end or bottom and the points of entrance are suitably sealed against moisture. After the magnet on the vehicle passes the end of the armature R, the latter is retained in position by its permanent magnetism assisted and conserved by the current flowing in the coils of the magnet P, said coils being included in the circuit between the supply conductor 27, and the armature or circuit closer R. The armature may be drawn up by electro-mag-

net T, on the vehicle and may be restored to normal position by electro-magnet T<sup>2</sup>. These magnets as shown, have their coils preferably included in a circuit from the motor circuit on the vehicle being, as indicated, in shunt relation to the electric motor M, which is included in the circuit taken up by the collector or collectors. There being two collectors L, L', in the form of my invention herein shown, it is placed in the direct circuit of the generator W, from one to the other of said collectors.

The electro-magnets T, T<sup>2</sup>, may be each formed as a horse-shoe magnet when two sets of switch boxes at opposite sides of the slot are used, one pole of the magnet acting on the armatures in the boxes at one side of the slot and the other pole upon those in the boxes of the opposite side. The polarities of the armatures R, would be of proper sign, as will be well understood, to be each attracted by the respective poles of the magnet T.

Assuming that the car is moving in the direction of the arrow Fig. 9, the electro-magnet T, would be the forward magnet and the rear electro-magnet T<sup>2</sup>, would have its poles reversed in relation to those of T, so that it would serve to repel the armatures R, and restore the latter to normal position as soon as the collector has left the working conductor to which the armature or circuit closer R, belongs. Inasmuch as it is desirable that this opening of circuit should not take place until the collector has left such section, it is desirable that the distance between the rear magnet and the collector should be somewhat greater than the distance between the forward magnet and said collector. As will be seen the length of the sections determines approximately the distance between the magnets.

The operation of the devices in opening and closing circuit for the section of working conductor will be obvious, the forward magnets completing the connections for the working conductor so that the collector may find the same alive before it leaves the section at the rear and as soon as it leaves the latter the rear magnet comes into play to depress the circuit closer R, and leave such section dead.

In the reverse movement of the vehicle the collector should be nearer the magnet T<sup>2</sup>, than it is to the magnet T. To provide for this the collector may be mounted, as shown in Fig. 6, and provided with mechanism whereby it may be shifted longitudinally of the car, assuming that the magnets are in fixed position, but as will be readily understood, the magnets or the collector might be moved to change their relative position as described. As shown in this figure the collector is mounted to slide longitudinally of the car in a guide frame 30, fastened to a bar carried by the car truck. Suitable chains or cords fastened to the slide enable it to be moved in either direction.

I do not wish to be understood as limiting myself to mounting the collector or collectors to make contact with the edge of the plates or

working conductors, since, as will be obvious, they might make connection with the top.

It will be obvious further that the distance between the two rows of plates, when two series are used so as to make a return by said plates, must be such as not to allow arcing between them, this distance in any case being determined by the voltage of the system. This may in some cases limit the voltage inasmuch as the width of the slot is limited by practical considerations. Where this difficulty is met with the return may be made by a separate line of conductors as, for instance, by the rails, or the two sides of the collector and the two lines of plates forming the top of the conduit may be spread to the necessary distance and the space between them closed by insulation, the collectors in such case making connection with the top of the plates.

If the magnets T, T<sup>2</sup>, are electro-magnets, it will be obvious that suitable means should be provided for changing their polarity when the car moves in the opposite direction. This may be done by means of suitable electric switches, as well understood in the art.

The circuits on the vehicle from the collector through the motor are clearly indicated in the diagram and being of any ordinary or suitable description need not be further described.

To prevent the establishment of an arc when the collector leaves the end of the two parallel working conductors, a sheet of insulating material 31, such as mica, may be supported between the two collectors. This sheet extends a sufficient distance beyond the edge of each collector to shut off the arc and not allow it to travel around the edge of the shield. This device is especially desirable where the automatic switch devices are adjusted and arranged to break connection only after the collector leaves the working conductor.

What I claim as my invention is—

1. In a conduit for railways, the combination with the railway tie or sleeper and the conduit having a groove on its bottom, of a key piece attached to the tie, as and for the purpose described.

2. The combination with an electric railway conduit, of interior oblique braces resting at the lower end in notches on one side of the conduit and squared at their opposite end to rest against the opposite side when dropped into place.

3. The combination with a conduit, of interior braces seated at one end in a notch on one side of the conduit and extending obliquely upward and resting at their opposite ends between lugs on the opposite side of said conduit.

4. In an electric railway conduit, interior brace pieces resting therein at an angle, and provided at their upper ends with supports for a longitudinal stringer of insulating material.

5. In a railway conduit, the combination with interior brace pieces, of a longitudinal

stringer of insulating material resting thereon near the side of the conduit and having tongue and groove connections with the braces.

6. In a railway conduit, the combination with the interior brace pieces, of a longitudinal stringer of insulating material supported thereon, and an automatic switch-box resting on said stringer.

7. The combination with the conduit interior braces, of a stringer and a switch box supported on said stringer and fastened to the side of the conduit.

8. In an electric railway system, an automatic switch-box having a cover provided with longitudinal extensions integral with it and constituting a working conductor.

9. In an electric railway system, an automatic switch box whose cover is provided with longitudinal extensions having a supporting foot or flange.

10. In an electric railway, the combination with a conduit having interior braces, of automatic switch boxes and electric extensions from the covers thereof supported on said braces.

11. In an electric railway, the combination with the conduit, of the interior braces and the switch boxes supported thereby and having longitudinal extensions forming a cover for the conduit and also supported by said braces.

12. In an electric railway, the combination with a conduit having interior braces for retaining the walls thereof in place, of switch boxes supported thereon, as and for the purpose described.

13. In an electric railway, the combination with the conduit, of the interior braces, the switch boxes resting thereon, and a cover for said conduit formed of the switch-box covers and electrical extensions thereof.

14. In an electric railway, the combination with a conduit, of a switch-box supported therein and a cover plate for said switch-box constituting by its side edge a working conductor for engagement by the collector of the car.

15. In an electric railway, a slotted conduit, the slotted cover of which consists of the covers of automatic switch-boxes.

16. In an electric railway, a slotted conduit holding an automatic switch-box whose cover and extensions thereof constitute at their edge the working conductor engaged by the collector which passes into the slot.

17. In an electric railway, the combination with the conduit having the supporting cross pieces, of the switch boxes carried thereby, and the insulating stringers applied to the side of the conduit between the same and the box, as and for the purpose described.

18. The combination with the conduit, of the switch boxes bolted to the side thereof and forming a cover for the conduit, as and for the purpose described.

19. The combination, substantially as described, in an electric railway having normally insulated working conductors, of two actuating magnets carried by the vehicle, one to close and the other to open the connections for the sections of working conductor, a collector mounted between said magnets, and means for changing the relative positions of the magnets and collector longitudinally of the vehicle, as and for the purpose described.

Signed at New York, in the county of New York and State of New York, this 13th day of April, A. D. 1894.

JOHN H. GUEST.

Witnesses:

WM. H. CAPEL,  
T. F. CONREY.