

(No Model.)

3 Sheets—Sheet 1.

C. K. HARDING.
ELECTRIC RAILWAY SYSTEM.

No. 451,637.

Patented May 5, 1891.

Fig. 1.

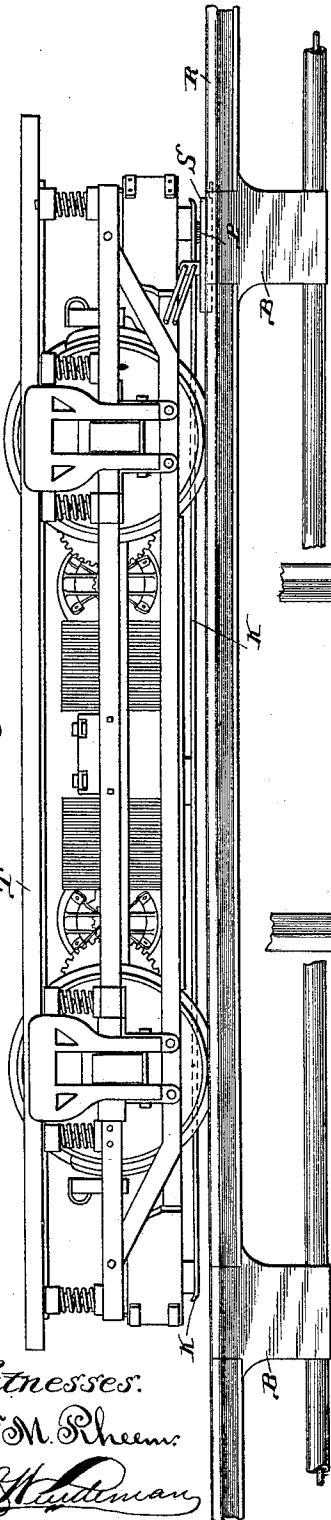
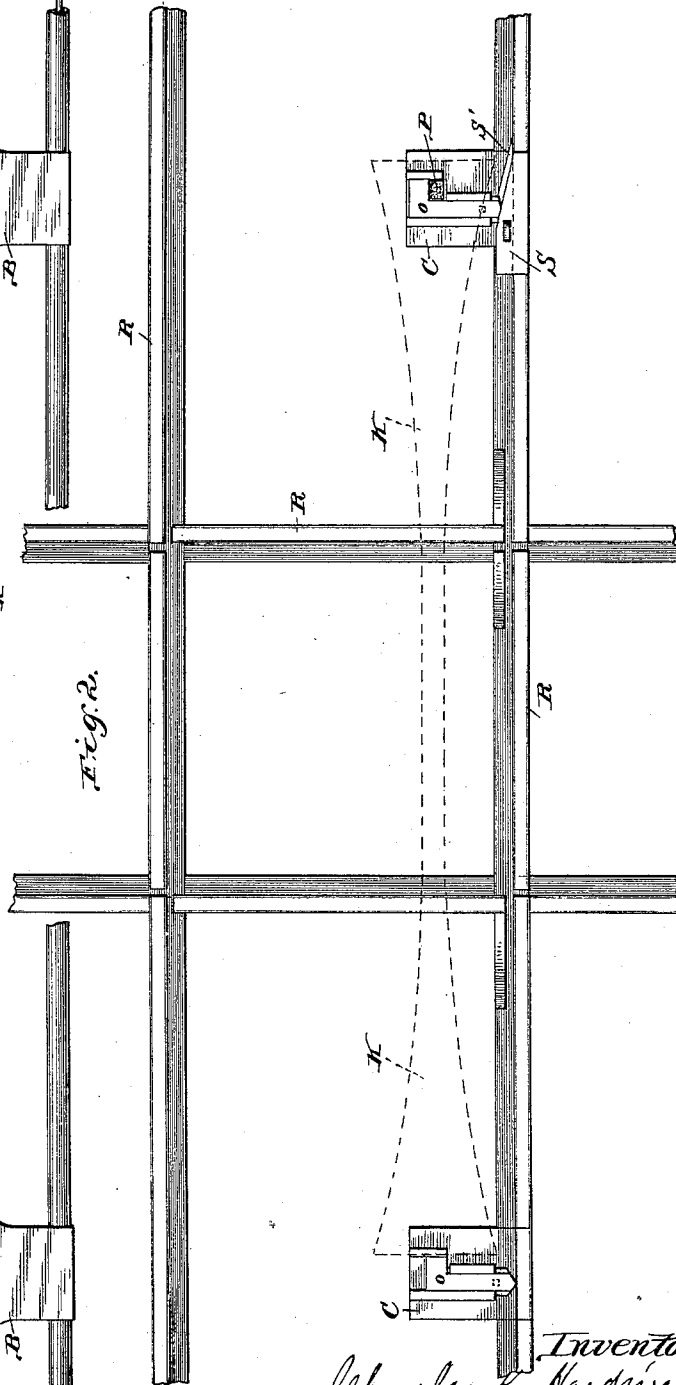


Fig. 2.



Witnesses:

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O. H. Hartman

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By *Wm. H. Hall & Brown*
Attys

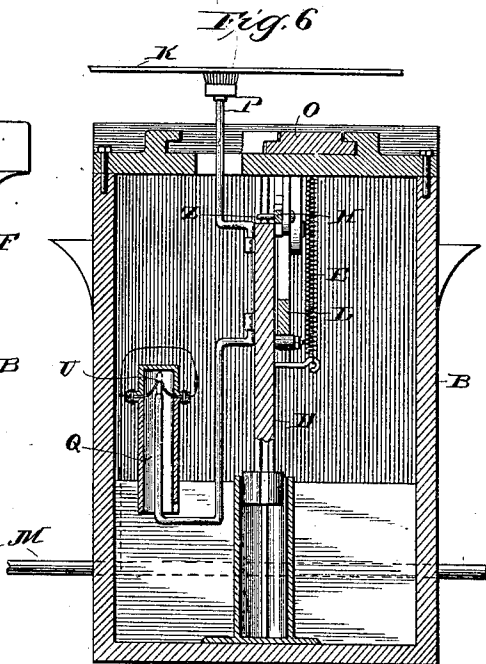
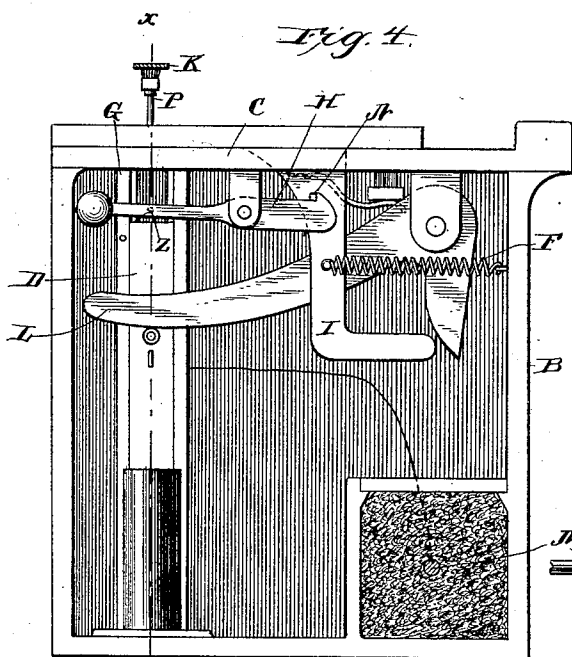
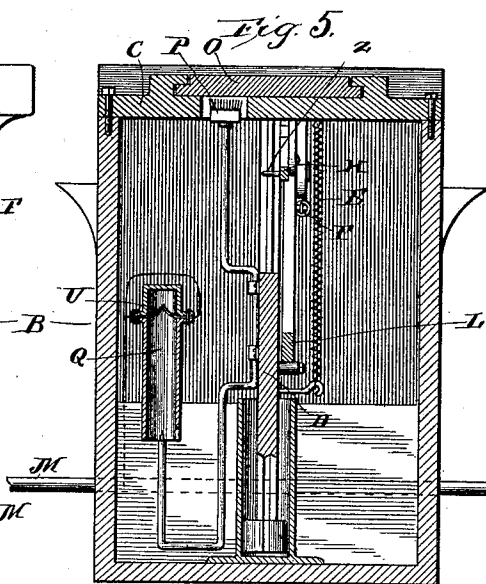
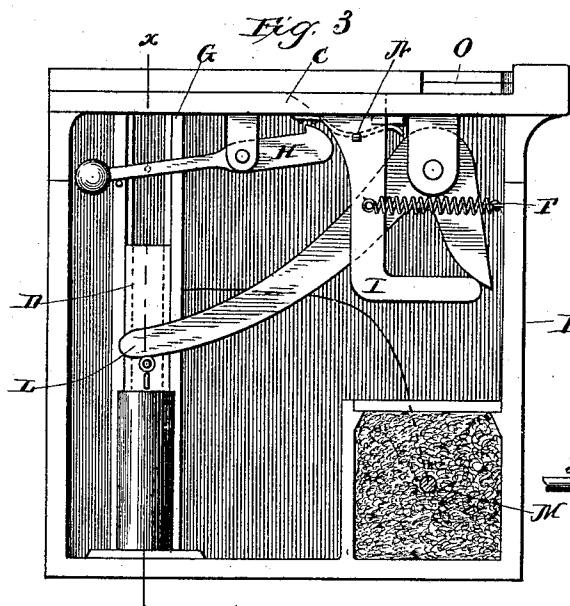
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3 Sheets—Sheet 2.

C. K. HARDING.
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No. 451,637.

Patented May 5, 1891.



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(No Model.)

3 Sheets—Sheet 3.

C. K. HARDING.
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Fig. 8.

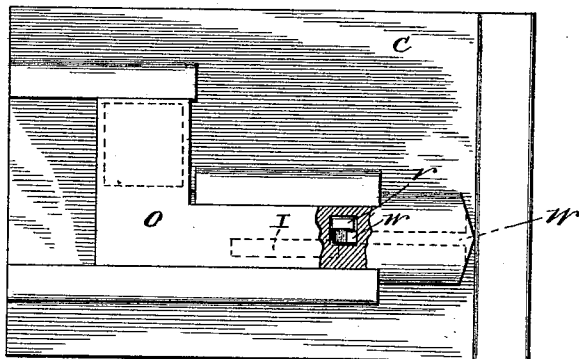


Fig. 9.

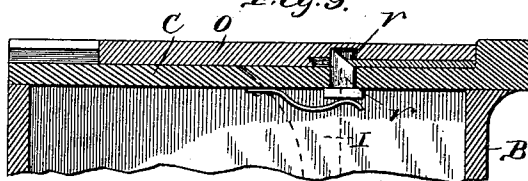


Fig. 10.

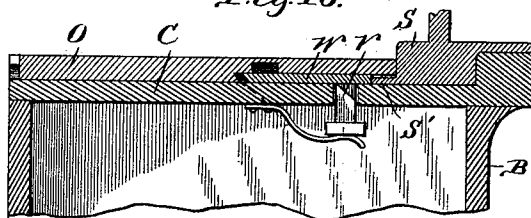
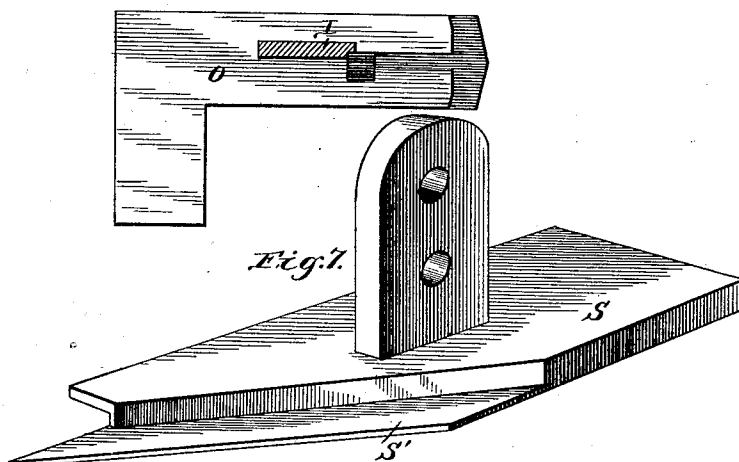


Fig. 11.



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UNITED STATES PATENT OFFICE.

CHARLES K. HARDING, OF ATLANTIC, IOWA.

ELECTRIC-RAILWAY SYSTEM.

SPECIFICATION forming part of Letters Patent No. 451,637, dated May 5, 1891.

Application filed October 27, 1890. Serial No. 369,436. (No model.)

To all whom it may concern:

Be it known that I, CHARLES K. HARDING, a citizen of the United States, residing at Atlantic, in the county of Cass and State of Iowa, have invented a new and useful Improvement in Electric-Railway Systems, of which the following is a specification.

This invention relates, generally, to an electrical railway system, and more particularly to a system of underground conductors therefor, and to the manner of operating the circuit between the same, and the devices upon the car which are to be operated thereby.

The invention will first be described, and then more particularly pointed out in the claims.

Like letters refer to the same parts in the several figures of the drawings, in which—

Figure 1 is a side view of a truck carrying the usual electrical devices, a certain attachment which I employ, and a portion or section of a track and a main conductor. Fig. 2 is a plan view of a section of a track including a crossing and two of the casings containing the circuit-completing devices, together with one of the shoes, and an indication of the collector in dotted lines. Figs. 3 and 4 are views in side elevation of the casing (with one side of the casing removed) and its inclosed mechanism, but respectively indicating the cover closed and the mechanism inactive and the cover open and the mechanism active. Figs. 5 and 6 are respectively cross-sections on the line X X of Figs. 3 and 4. Fig. 7 is a perspective view of my improved shoe. Fig. 8 is a plan view of the cover of the box, with a part broken away. Fig. 9 is a vertical cross-sectional view of the same, showing the locking arrangement. Fig. 10 is similar to Fig. 9, except that the shoe is shown in place in the act of unlocking the cover; and Fig. 11 is a detail view.

The main idea of the present invention is to provide a subterranean conductor for an electric railway which will have thorough insulation and at the same time will be concealed from view and be secured from outside interference, and yet will afford ample and easy provision for connection with the car and its electric motor. Generally speaking, these ends are accomplished by carrying a covered wire adjacent to a rail and through

a series of normally-closed casings or boxes in which electrical contact is made with the main conductor by means of a circuit-completer whose opposite ends may be projected simultaneously into contact with a bared portion of or a branch from the main conductor, and with a current-collector or contact upon the car. Provision is also made for additionally protecting the main conductor, contact, or branch from water or moisture by incasing the same in an inverted cup or bell or similar device. A sliding cover is provided to normally close the aperture in the casing through which the current-completer is to be projected, and the car carries a short shoe which operates the cover, and indirectly, through other mechanism, moves the circuit-completer into and out of contact.

It is obvious that many variations may be made in the details of my invention without departing from its spirit; and I do not wish to be understood as intending to limit myself to the specific construction, which will now be described as an illustration of the best manner yet devised by me of carrying out the general plan of the invention.

Adjacent to the rails R R, preferably between the same and near one of them, are arranged two or more boxes or casings B B, which may be made of cast-iron or other suitable material, and the main portions of which are designed to be placed below the level of the track. These boxes are placed at any convenient distances apart, and inclose certain mechanism which will be hereinafter described. Practically parallel with the rails and adjacent to the inside of one of them is arranged a main conductor M, which has an insulating-covering, and passes through the boxes B B, preferably near one corner thereof, as is shown in the drawings. The corner through which the main conductor passes may be divided by suitable partitions from the rest of the box and filled with insulating substances surrounding the conductor, as illustrated in Figs. 3 and 4 of the drawings. The slide-bar D is arranged to move freely in the vertical guides G G, which are arranged in the box, and has connected with its lower end a piston working in a cylinder supported upon the floor of the box, thus constituting a dash-pot. Of course this dash-pot is pro-

vided with a groove or aperture to permit the air to slowly escape in the usual manner. A spiral or other spring E has one of its ends connected to the slide and the other end to the top C, and consequently there is a constant tendency for the slide to move upward; but this tendency is normally overcome by the pressure of the long arm of the elbow-lever L upon a stud or pin attached to the side of the slide, the short arm of such elbow-lever being normally pressed upward by the arm I, which is affixed to the sliding portion of the cover, and is caused to press upon the lower end of the short branch of the lever by the action of a spiral spring F, the two terminals of which are respectively affixed to the arm I and to the inside of the box. Pivoted in suitable brackets attached to the cover is a lever H, one end of which I prefer to weight and the other end to form as a hook.

Upon the side of the arm I is a pin N, with which the hooked end of the lever engages, and the hook is beveled in one direction to permit the pin to pass freely over it when it is moving in the direction of such bevel. Secured to one side of the slide-bar, but insulated therefrom, is what I designate as the "circuit-completing device." It is marked by the letter P, and is formed of the J-shaped rod, which may have a contact-brush at its upper end and a platinum or other contact-point at its lower upturned end. Arranged within an inverted bell or cup Q are contact-springs W, which are electrically connected with the main conductor. In place of the contact-springs, any other form of electrode may be employed at this point. It is manifest that by inclosing the contact-spring or other electrode within the bell the contained air will prevent water from rising to such contacts and injuring them. In other words, the cup acts on the diving-bell principle. The top C is provided with an opening therethrough, and arranged to move in suitable ways formed upon said top is a movable cover O. In order to prevent children and meddlers from interfering with this opening, I prefer to provide the cover with an automatic lock of any suitable construction. A convenient form of lock is illustrated in Figs. 8, 9, and 10 of the drawings. This lock which is shown consists of a spring-acted lug V, one side of which is rectangular and abrupt in contour, and the other side of which is beveled toward the outer side of the box. The under side of the cover is provided with a recess for this lug or bolt, and with a groove extending from the recess to the outer extremity of the cover, in which groove is placed a strip W, which latter at its outer end is wedge-shaped, as is shown, and has its inner end beveled to correspond with and rest against the beveled side of the lug.

Secured to the under side and near one end of the truck pivotally by parallel bars is a shoe S, which I prefer to construct as is shown in Fig. 7, in which one end of the shoe, as

shown, is beveled, and has a thin flange or extension S'. Secured also to the under side of the truck and in the vicinity of the track is a current-collector or contact K, which may be made of any suitable conducting material and shape, and is electrically connected to the current-controlling devices and the electrical motor thereon, and thence to the ground or return conductor in the usual manner.

The operation of the parts hereinbefore mentioned will now be described. The main conductor is thoroughly insulated and has no portion exposed outside of the box. Within the box the contact between the main conductor and the lower end of the circuit-completing device is made within the bell near the upper end thereof, whereby all water which may arise within the bell is excluded from approaching the exposed electrodes. By this manner of doubly protecting the exposed portions of the electrical conductors, leakage is to a great extent avoided and such perfect insulation attained that a current of greater voltage may be employed. Normally the circuit-completing device is contained completely within the box or casing, and the circuit between the main conductor and this connecting device is broken. Moreover, the hole in the top of the box is covered and the cover is locked in position. When, however, a car carrying a shoe passes over these boxes the shoe presses against the beveled outer end of the cover and slides the latter along so as to uncover the opening, the lug or bolt being withdrawn by the flange of the shoe, causing the strip W to depress the lug or bolt. The cover, in uncovering the hole in the top of the box, carries with it the arm I and relieves the elbow-lever from the pressure of such arm, whereupon the spring E throws the sliding bar D upward and the latter carries with it the circuit-completing device P, and thus makes the contact between the lower end of the latter and the branch of the main conductor, and at the same time between the brush upon the upper end of such circuit-completer and the current-collector upon the car. The shoe, however, is made quite short, so as to adapt it to round curves, and therefore the electrical circuit between the main conductor and the car would be maintained only for the instant during which the shoe was acting upon the cover if no other provision were made; but as the cover is moved by the shoe the pin N on the bent bar I slides over the curved and bent end of the lever H and is caught by the hook upon the latter, and thus the cover is held open and the brush in contact with the current-collector as long as the latter is over the said brush. When the current-collector passes beyond the brush, the spring E carries the sliding bar a little farther up and causes the same to strike a pin Z, which is arranged upon the side of the lever H, near the weighted end thereof, and causes the hooked end of such lever to become disengaged from

the pin and the bar I, and consequently the spring F, which is more powerful than the spring E, exerts its force so as to cause the cover to close the opening and cause the elbow-lever L to depress the circuit-completer. Of course the current-collector normally must be long enough so as to extend over the second box before it passes beyond the first box.

Having thus described my invention and the best way which I have up to this time devised for carrying it out, I will now state what I desire to claim and secure by Letters Patent—

1. In an electric-railway system, the combination of an insulated main conductor, a series of stationary main-conductor contacts or electrodes protected in insulated cups, electrically-propelled vehicles having current-collectors carried thereunder, and a movable circuit-completing device normally insulated from the main-supply conductor, but adapted to contact with the main conductor, substantially as described.

2. In an electric-railway system, the combination of an insulated main conductor, a series of casings having openings through the same, movable covers for such openings, stationary main-conductor contacts located in the top of insulating-cups within said casings and held out of contact with the main-conductor electrode by mechanism controlled by said cover, but adapted when released to move the contact with the main-conductor electrode and the current-collector on an electrically-propelled vehicle simultaneously, and a device carried by the cars for removing said covers and allowing the circuit-completing device to operate, substantially as described, and for the purpose set forth.

3. In an electric-railway system, the combination of an insulated main conductor, main-conductor contacts located in a series of boxes or casings having portions with sliding covers for same, circuit-completing devices normally retained in said casings and controlled by mechanism operated by said covers, a car having an electric motor and carrying a current-collector thereunder connected therewith, and a device for removing the covers, consisting of a short shoe adapted to follow the groove of one of the track-rails and a catch for retaining the cover in an open position while the car is passing and adapted to be released by the circuit-completing device after the current-collector has passed, substantially as shown and described, and for the purpose set forth.

4. In an electric-railway system, the combination of an insulated main conductor, a casing having an open portion, a spring-pressed circuit-completing device normally contained in such casing, a detent for restraining such circuit-completer, a car provided with an electric motor, a contact, and also a device for opening the cover and releasing the detent, substantially as and for the purpose set forth.

5. In an electric-railway system, the combination of an insulated main conductor, a casing having an open portion, a movable cover for such open portion, a spring-projected completing device normally contained in such casing, an elbow-lever one end of which rests upon the projection upon the circuit-completer, and a bent arm secured to the movable cover and normally pressing upward the shorter arm of the elbow-lever, a car having an electric motor, a contact, and also a device for removing the cover from the opening, and thereby releasing the circuit-completer and permitting the same to be projected into the path of the contact upon the car, substantially as shown and described.

6. In an electrical-railway system, the combination of an insulated main conductor, a casing having an open portion, a movable cover for such open portion, a spring-pressed circuit-completing device normally contained within such casing, an elbow-lever having one arm resting upon and serving to depress the circuit-completer, a bent arm secured to the cover, and a spring for normally forcing the same against the shorter arm of the elbow-lever, a weighted lever having a hook at one end for engaging a pin upon the bent arm, and a lug or stud upon its side arranged in the path of the circuit-completer, a car having an electric motor and current-collector or contact extending thereunder and serving to limit the extent of the stroke of the circuit-completer, and a short shoe suspended so as to strike and operate the movable cover, substantially as shown, and described.

7. In an electric-railway system, the combination of an insulated main conductor, a casing having an open portion, a movable cover, a lock for the same, a circuit-completer normally contained within such casing, a car having an electric motor, a current-collector or contact, and also a device for releasing the lock and moving the cover from the opening, substantially as shown and described.

8. In an electric-railway system, the combination of a casing and an insulated main conductor having its exposed electrode or contact within a reversed bell or cup located within the casing, and a J-shaped circuit-completer having one end adapted to contact with the electrodes within the bell or cup and the other end designed to contact with the current-collector on the car, substantially as shown and described.

9. In an electric system, the combination of an insulated main conductor, a series of casings having open portions, circuit-completing devices normally contained within the casings, and a car having current-collectors at least equal in length to the distance between two of the casings, and said car also carrying a short shoe for removing the covers from the opening in said casings, substantially as shown and described.

10. In an electric-railway system, the combination of an insulated main conductor, a casing having an open portion, a movable cover for such open portion, a spring-projected completing device normally contained in such casing, an elbow-lever one end of which rests upon the projection upon the circuit-completer, and a bent arm secured to the movable cover and normally pressing upward the shorter arm of the elbow-lever, a car having an electric motor, a contact, and also a device for removing the cover from the opening, and thereby releasing the circuit-completer and permitting the same to be projected into the path of the contact upon the car, substantially as shown and described.

- bination of an insulated main conductor, a main-conductor contact or electrode insulated and protected in the top of an insulated cup, a car having an electric motor and a current-
5 collector, a circuit-completing device, and means for projecting it simultaneously into contact with the current-collector and the main-conductor contact or electrode, substantially as described.
- 10 11. In an electric-railway system, an insulated main conductor provided with contact portions or electrodes protected in inclosed casings or boxes, an electrically-propelled vehicle carrying a current-collector of a length
15 at least equal to the distance between the casings or boxes, a circuit-completing device normally contained in the latter, and mechanism including a cushion for preventing the noise and jar and the too rapid operation of the parts, substantially as and for the purpose
20 set forth.

CHARLES K. HARDING.

Witnesses:

A. G. WATERMAN,
WM. S. CAMERON.