

(No Model.)

2 Sheets—Sheet 1.

M. J. WIGHTMAN.

RAIL CONNECTION FOR ELECTRIC RAILWAYS.

No. 460,615.

Patented Oct. 6, 1891.

Fig. 1.

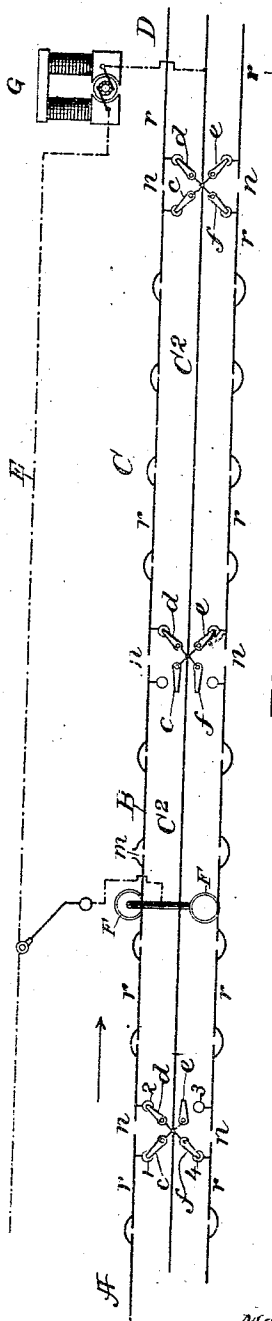
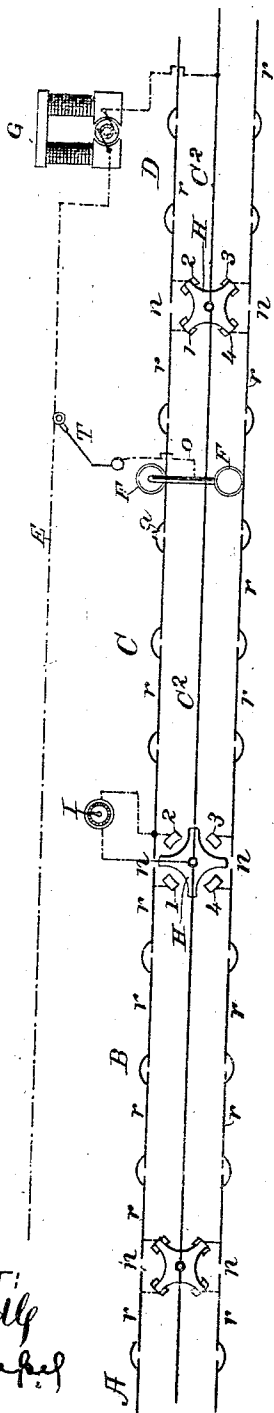


Fig. 2.

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By J. H. Townsend
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2 Sheets—Sheet 2.

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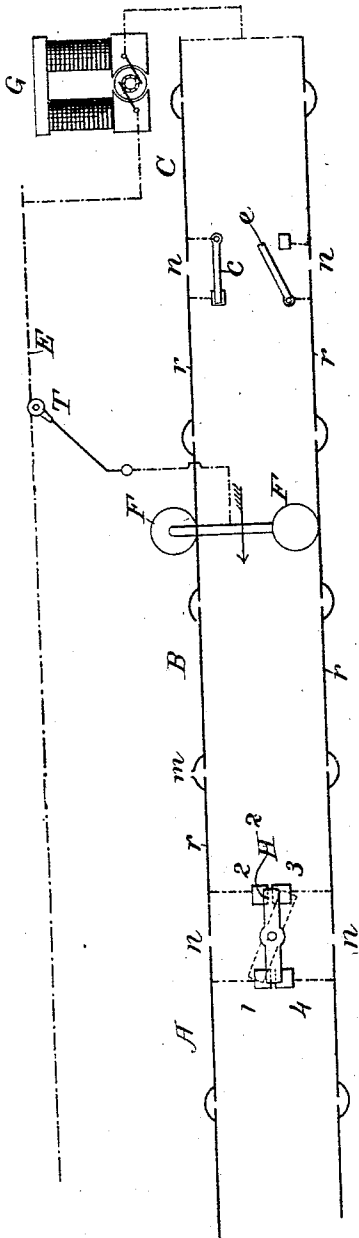


Fig. 3.

Fig. 6.

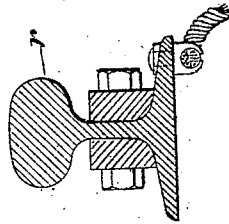


Fig. 5.

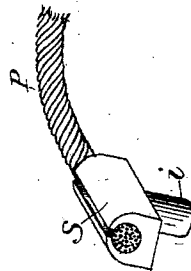
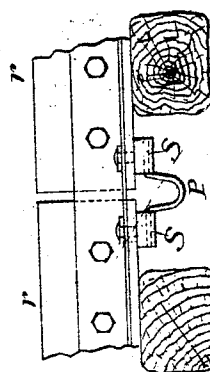


Fig. 4.



ATTEST:

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UNITED STATES PATENT OFFICE.

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RAIL CONNECTION FOR ELECTRIC RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 460,615, dated October 6, 1891.

Application filed May 16, 1891. Serial No. 392,825. (No model.)

To all whom it may concern:

Be it known that I, MERLE J. WIGHTMAN, a citizen of the United States, and a resident of Scranton, in the county of Lackawanna and State of Pennsylvania, have invented a certain new and useful Rail Connection for Electric Railways, of which the following is a specification.

My invention relates to those electric-railway systems in which the rails of the track are used as the return-circuit for the electric energy taken-off from a separate leading or supply conductor for operating the railway-motor. Such separate leading or supply conductor is usually supported over the car and is known as a "trolley-wire," but might be any conductor running along the line of track—as, for instance a conduit-conductor.

My invention is applicable to any system in which a rail-return is used after the manner ordinarily employed in connection with a trolley-wire; and the object of the invention is primarily to improve the life of such rail-return circuit and to provide for the ready location of faults.

The systems hitherto employed have been chiefly deficient because of their short life or early deterioration, the result being serious drop of voltage at points distant from the supply-station. In the rail-return circuit as first employed reliance was placed wholly upon the rails themselves for conducting the electricity back to the supply-station, and provision was made for connecting the rail ends by means of a good conductor, ordinarily consisting of a stiff copper or iron wire, which was riveted or secured to the adjacent ends of the rail. In this system the breaking of one joint would increase greatly the total rail resistance, and it therefore became necessary to use a so-called "supplemental wire" running parallel to the rails and between or just outside one of them and to connect the rail-bonds which electrically joined the ends of adjacent rails to the supplemental wire or return by means of short connections. Whether used alone or in connection with the supplemental return-wire, the rail-return circuit thus employed has proved to be serviceable for a period of only a year or so, the breaks at the rail-joint after that time increasing very rapidly, the result being a

gradual deterioration of the entire system. In the previous construction of the systems it would be impossible to remove the fault or improve the system without exposing the entire rail-section, which, in a paved roadway, would be very expensive.

The principal advantage of the system which constitutes the present invention lies in the fact that it is possible to locate any single break in the rail-return circuit or fault of any nature as soon as the same occurs and the entire system can be maintained in perfect repairs.

The invention consists, essentially, in dividing the rail-return into sections of from one to five hundred feet each, more or less, as may be found convenient, and connecting such sections through switches of any sort, which will form the whole into the ordinary rail-return circuit, but which are adapted to be turned at will to break connection from one section to the other for the purpose of locating the fault in the section where such fault is expected to exist.

My invention consists, further, in a novel construction of a flexible-wire bond or connection between the ends of adjacent rails, as hereinafter more particularly described and claimed.

I have shown my invention as applied both to a system in which the supplemental wire return is employed and to a system in which dependence is placed wholly upon the rails themselves as the return-circuit. When the invention is applied to a system having a supplemental return-wire, the connection therewith is made not at each bond between two rails, but at the ends of the sections through a switch, which may be turned to break the connection at pleasure. The same switch or a separate switch may be depended upon for disconnecting at will the rails of two adjacent sections.

It will of course be understood that the sections are reasonably well insulated from one another by means of insulating chairs, as well understood in the art.

In the accompanying drawings, Figure 1 is a diagram illustrating the application of my invention to a railway wherein a supplemental return-wire is used in connection with the rail-return circuit. Fig. 2 is a diagram illus-

trating a modification in the manner of carrying out my invention. Fig. 3 is a diagram illustrating the application of the invention to a system wherein dependence is placed upon the rails entirely for forming the return connection. Fig. 4 is a side elevation of the adjacent ends of two rails connected by the improved rail-bond. Fig. 5 is a perspective view of one end of the device forming the electric bond or union between the ends of adjacent rails. Fig. 6 is a cross-section through a rail, illustrating the manner of fastening the ends of the rail bonds or unions to the rail.

G is any electric generator which supplies electric energy to the trolley-wire E, and the rails of an electric railway, the portion of which illustrated is divided into four sections A B C D, insulated from one another at the points *n*.

C² is the supplemental return-wire, connected to the opposite pole of the generator from that which connects to E.

The trolley by which the electric energy is drawn off from the wire E is indicated at T, while F F indicate the wheels of any railway car or vehicle which runs upon the rails *r*. The current flows in the usual way from the trolley T through the devices on the car or vehicle, thence through the wheels and to the rails of the track. The rails are a rail-return circuit for the electricity, and the several sections described are supposed to be normally connected with one another through suitable switch devices that may be turned to break the connection from one section to the other. Switch devices are also employed for breaking the connection between the rails and the supplemental return-wire C². It is convenient to employ the same switch devices or both purposes. In the present case, as will be seen, the ends of adjacent sections of rail-return are connected to the contact-points 1 2 3 4 of an electric switch device, which may be conveniently made with a single rotating member H, consisting of a plate having four arms, as shown, adapted to rest upon the contacts 1 2 3 4, as shown, and itself electrically connected with the supplemental return-wire in any suitable manner. Ordinarily the switches would stand in the position indicated at the right of the figure, thus forming connection between the adjacent ends of the several sections, and likewise making connection between each section at its end and the supplemental return-wire.

The operation of the system illustrated in Fig. 1 is as follows: If it be noticed that the voltage diminishes on any particular section more than upon others, this points to the fact that some one of the rail-bonds in that section has broken or has become defective as a connection, and in order to locate exactly the break the switch at one or the other end of said section will be turned to break the connection of such section with an adjacent section. Let it be supposed that the break of a rail-bond

is suspected in the section C, then one of the switches connecting said section with B or D would be turned—as, for instance, that connecting it with B—into the position indicated and an ammeter I placed in the connection between that end of the section which is thereby disconnected from B and the supplemental return-wire C² by any proper connecting devices. If the break be, for instance, at the point *a*, then the car in passing along the track in the direction indicated by the inclination of its trolley would as soon as it passed the break *a* cause a current to flow through the ammeter or other suitable indicator I, thus indicating the point at which the break is located. If the car were moving in the other direction and approaching the break from the end of the section C at which the switch has been turned and the ammeter or indicator in circuit, then current would flow through such ammeter or indicator from the car until the break is reached, but on passing the break current will suddenly fall or stop. If the switch at the opposite end of the section were also opened, so as to disconnect the opposite rail likewise from the supplemental return-wire, then the passage of the car over the break would cause a sudden flash or arc to appear at such defective point, and in this instance the use of any ammeter or indicator at I would be unnecessary. In such case, however, a substitute connection for that formed by the ammeter would have to be employed.

Fig. 2 illustrates a modification of my invention in which the switch is provided with four independent switch-arms *c d e f*, corresponding to the arms of the single switch-plate H. This modification furnishes a ready means for locating the break by the arc or flash formed when the car passes the defective bond and makes it unnecessary to use an ammeter or indicator or any substitute device. In order to test or locate the break on section B, for instance, the switches at opposite ends of said sections, which normally would be in the position indicated at the right of the figure, would be turned to the position shown, thus disconnecting the section at one side from adjacent sections at both ends, disconnecting the opposite side at one end and leaving it in connection with the supplemental return at the other. If the car pass in the direction indicated by the arrow, then it is obvious that circuit would be maintained through the same so long as it remained on said section B, if there were no break in the said section on the side thereof which remains connected to the supplemental return-wire; but on passing any break—as, for instance, at the point *m*—then the location of such break would be shown by the appearance of a flash or arc. Should the car pass entirely over the section without any such indication appearing, then the switches would be turned so as to place the opposite side of said section in the same relation to

the system and to disconnect entirely the first side. The same test would then be applied to the second side of the section. In the same manner the switches might be turned to disconnect one side of the track of any section entirely and to place the other side in connection with the supplemental wire at one end only, its opposite end being disconnected from the adjacent section of rail-return, and therefore out of connection with the generator.

Fig. 3 illustrates the application of my invention to a system wherein no supplemental return-circuit is employed. The modification illustrated in Fig. 3 is only applicable to short lines and can only be used for testing purposes when there are no cars distant from the power supply beyond the point where the break exists. Each switch device connecting one section with an adjacent section might be constructed, as shown at the right of the figure, with independent arms *c* *e*, or it might consist of a single switch-plate *H*², such as indicated at the left of the figure, similar to that illustrated in Fig. 1, and adapted when standing in the position shown in the full lines to connect the points 1 2, as well as the points 3 4. To locate a fault in section B, the switches could be turned into the position indicated, leaving the side of said section to be first tested in connection with the generator at its end nearest the generator, but disconnecting its opposite end from the adjacent section and the rest of the rail-return. The opposite side of said section B would be disconnected from the adjacent section C, so that the car on passing on section B would receive current only through the side to be tested. It is obvious that if the car were moving in the direction of the arrow then on passing the defective point *m* the strong arc or flash would appear, and after passing said break the car would receive no current. If the car could be propelled over the whole section B, then it would be obviously clear that the defect, if any, existed on the other side, and to locate the defect the latter side would be connected to the section C and the opposite side first tested would be disconnected. The same test would then be applied in the same way and the fault located in the same manner.

In Fig. 4 I have shown the adjacent ends of two rails united by my improved flexible union or bond. This device consists of a short length of cable made of copper, iron, or other conductor, (indicated at *P*), which has attached to each end a block of metal *S*, which is adapted to be headed or riveted in a hole in the flange or web of the rail, as indicated more clearly in Fig. 6.

To facilitate the placing of the bonds and fastening of them in place, it is advisable to provide the block or head with a lateral extension *t*, which is adapted to enter the hole in the rail and to have its end headed or riveted down in place. By thus fastening the

heads of the connection I avoid the difficulty which is found frequently to exist when the unions are fastened to bolts, which are liable to loosen with the continual jarring or jolting at the rail ends.

The head or block of the bond or union is attached to the flexible conductor in the manner shown in Fig. 5, where it is illustrated as molded or punched in such form that it can be crimped or bent down upon the end of the cable. After being so clamped it may be soldered, if desired.

What I claim as my invention is—

1. In an electric railway, a rail-return divided into sections insulated from one another and provided with intermediate electric switches normally connecting said sections with one another, but each adapted to be turned at will to break the connection between adjacent sections of said rail-return, as and for the purpose described.

2. In an electric railway, the combination, with a rail-return divided into sections insulated from one another, of electric switches normally connecting the ends of adjacent sections and adapted to be turned at will to disconnect either side of any section from the rails of an adjacent section.

3. In an electric-railway system, the combination, substantially as described, of a rail-return divided into sections, a supplemental return-conductor, and electric switches and connections whereby the said sections of rail-return may be connected at their ends to one another and to the said supplemental return.

4. In an electric-railway system, the combination, substantially as described, of a rail-return divided into sections, a supplemental return-conductor, and independent switch arms and connections, as described, whereby either side of any section of rail-return may be disconnected from the return-conductor and an adjacent section at one end without breaking the connection of the other side.

5. In an electric-railway system, the combination, substantially as described, of a rail-return divided into sections, a supplemental return-conductor, and connections between said sections and the return-conductor through switch devices at the ends of adjoining sections.

6. In an electric-railway system, the combination, with a rail-return divided into sections, of connections between opposite sides of the same section and an adjoining section through independent electric switch devices.

7. In an electric-railway system, the combination, with a rail-return divided into sections, of four switch contact-points 1 2 3 4 at the adjoining ends of two sections, and switch devices for connecting each side of a section with a side of an adjoining section through said contacts.

8. An electric union for railway-rails, consisting of a flexible conductor provided at its ends with attached solid blocks headed in

holes in said rails, as and for the purpose described.

5 9. An electric bond or union for the ends of railway-rails, consisting of a flexible conductor provided with solid heads crimped around the end of the conductor and provided with a lug or projection, as and for the purpose described.

Signed at Scranton, in the county of Lackawanna and State of Pennsylvania, this 11th day of May, A. D. 1891.

MERLE J. WIGHTMAN.

Witnesses:

HORACE E. HAND,
HERMAN BERGHOLTZ.