

No. 707,591.

Patented Aug. 26, 1902.

F. A. HOWARTH.  
UNDERGROUND TROLLEY SYSTEM.

(Application filed Nov. 22, 1901.)

(No Model.)

2 Sheets—Sheet 1.

FIG 1

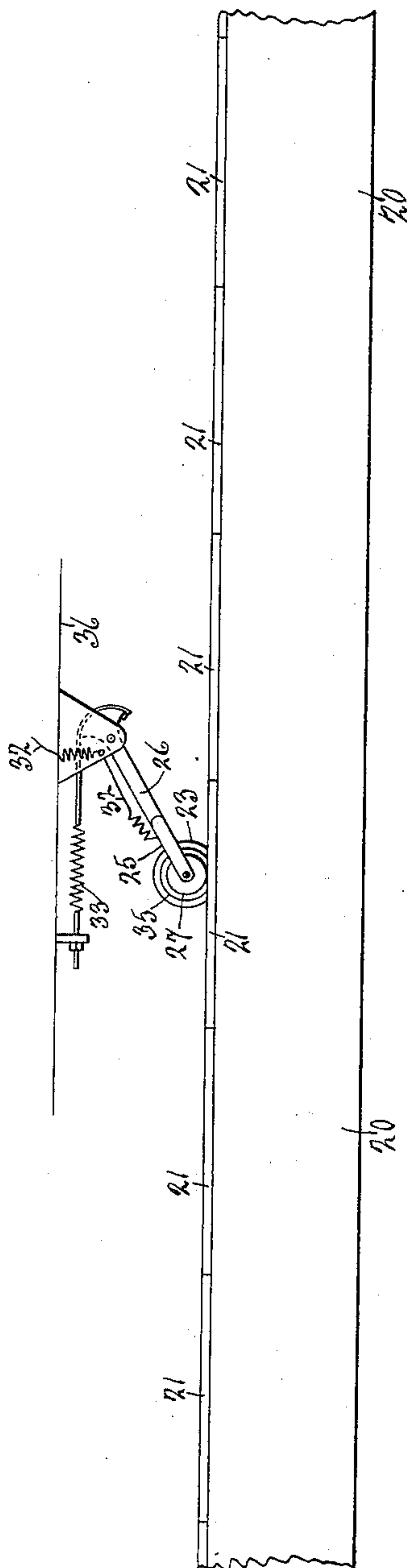
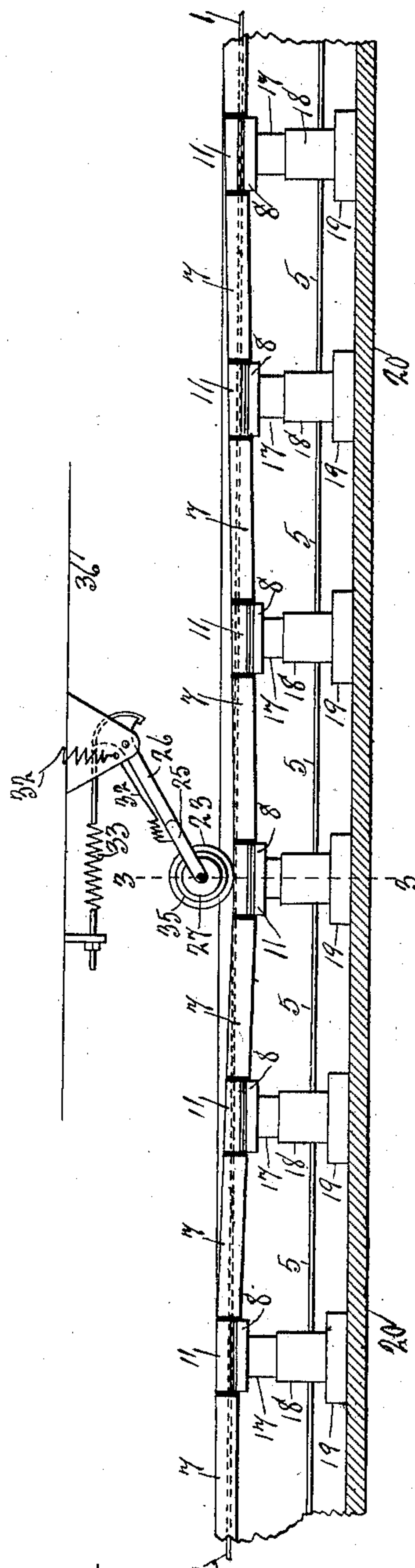


FIG 2



WITNESSES

Wm. S. Greer

E. M. O'Reilly

INVENTOR

Fred A. Howarth  
By Mosher & Carter  
Attys

No. 707,591.

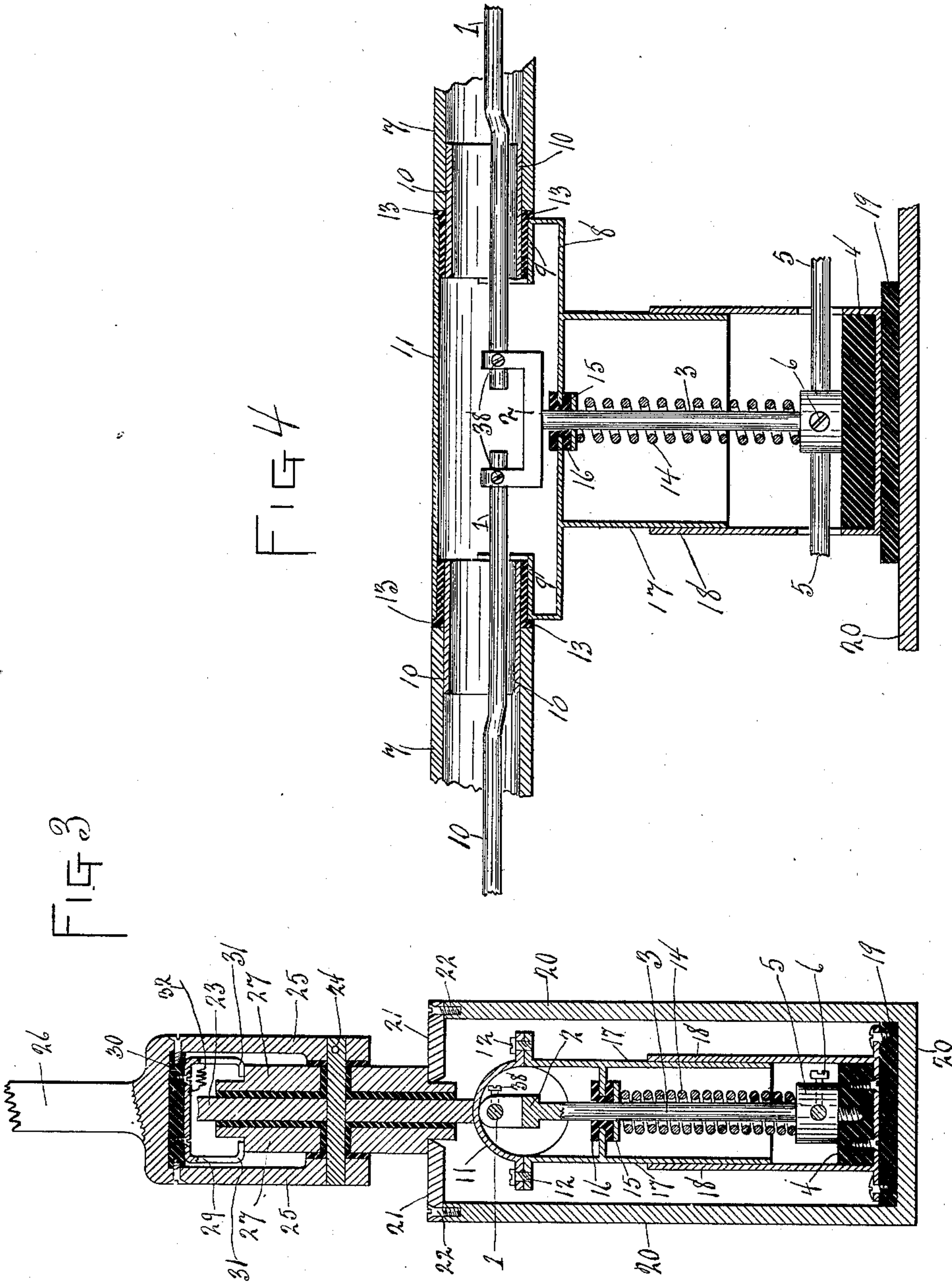
Patented Aug. 26, 1902.

F. A. HOWARTH.  
UNDERGROUND TROLLEY SYSTEM.

(Application filed Nov. 22, 1901.)

(No Model.)

2 Sheets—Sheet 2.



WITNESSES

Wm. S. Greer

E. M. O'Reilly

INVENTOR

Fred A. Howarth  
By Mosher & Curtis  
Attys



# UNITED STATES PATENT OFFICE.

FRED A. HOWARTH, OF JOHNSTOWN, NEW YORK, ASSIGNOR OF ONE-HALF  
TO HENRY L. SHAVER, OF COHOES, NEW YORK.

## UNDERGROUND-TROLLEY SYSTEM.

SPECIFICATION forming part of Letters Patent No. 707,591, dated August 26, 1902.

Application filed November 22, 1901. Serial No. 83,257. (No model.)

*To all whom it may concern:*

Be it known that I, FRED A. HOWARTH, a citizen of the United States, residing at Johnstown, county of Fulton, and State of New York, have invented certain new and useful Improvements in Underground-Trolley Systems, of which the following is a specification.

The invention relates to such improvements; and it consists of the novel construction and combination of parts hereinafter described and subsequently claimed.

Reference may be had to the accompanying drawings, and the reference characters marked thereon, which form a part of this specification.

Similar characters refer to similar parts in the several figures.

Figure 1 of the drawings is a view in side elevation of the conduit portion of my improved apparatus, partly broken away. Fig. 2 is a central vertical longitudinal section of the conduit, showing in side elevation the conductor and contact mechanisms of my improved system. Fig. 3 is a vertical cross-section, on an enlarged scale, taken on the broken line 3 3 in Fig. 1, through one of the splice-boxes and trolley. Fig. 4 is a central vertical longitudinal section taken through one of the splice-boxes.

My invention relates to that class of electric railways employing a supply-conductor located beneath the road-bed from which the motors of the cars are supplied through a trolley or other contact device carried by the cars.

Referring to the drawings, the supply-conductor is preferably made up of a plurality of short sections 1, the neighboring ends of neighboring sections being detachably secured to stationary supports, as in the arms of the yoke 2, on the upper end of the posts or upright 3, erected from an insulating-block 4. The sections of the supply-conductor are thus secured together in a conductive series, and the conductor may be connected with a source of electrical energy in any known manner, as by the feed-wire 5, inserted in apertures in the bases of the several posts and secured therein by set-screws 6, the feed-wire connecting with a dynamo (not shown) or other source of supply. The sup-

ply-conductor is incased in a flexible tubular inclosure comprising a series of insulated conductive tubular sections 7, inclosing the intermediate portions of the respective supply-conductor sections and alternating with splice-boxes 8, which connect together the ends of the respective conductor-sections. The body of the splice-box is provided at its opposite ends with seats 9, adapted to receive the neighboring ends of the neighboring tube-sections 7 or the splice-bushings 10, projecting therefrom, as shown in Fig. 3, and support the same. The splice-box is provided with a suitable cap or cover 11, detachably secured thereto, as by the screws 12, and adapted to clamp the splice-bushings 10 in their seats in the body of the box, and thereby secure the neighboring ends of the two connected tube-sections 7 in proper relative position. The insulating-sleeve 13 incloses the splice-bushing 10 and serves to insulate the tube-sections 7 from the splice-box. By means of the splice-bushings 10, inserted in the ends of the tube-sections, I am able to employ sections 7 of ordinary tubing to properly support the tube-sections, insulate the same, and maintain the upper surface of the splice-box cap in alignment with the tube-sections, forming a practically continuous surface for engagement with the trolley or other contact mechanism carried by the car. The inclosing tubular case thus formed is yieldingly supported with its sections out of contact with the supply-conductor by means of springs 14, inclosing the several conductor-supporting posts 3 and severally bearing at the lower end upon the base of the post and at the upper end upon the under side of the splice-box through the interposed bearing-plate 15 and insulated packing 16. The splice-boxes are thus permitted a yielding movement longitudinally of the posts 3, being guided by means of the telescoping members 17 and 18, which inclose the several posts, the stationary member 18 being mounted upon the insulating-block 19, secured upon the bottom of the conduit 20, adapted to contain the mechanism above described. The conduit is provided with a slotted cover formed by removable plates 21, detachably secured to the body of the conduit, as by screws 22, the members be-



ing so arranged that the springs 14 are adapted to yieldingly support the tubular supply-conductor inclosure in contact with the under surface of the cover-plates 21 in position to close the slotted opening in the tube of the conduit. The conduit is formed wholly or partly of conductive material adapted to form a return-conductor, and I provide the several cars with contact mechanisms of different polarity, one adapted to engage the flexible supply-conductor inclosure and depress its sections successively into contact with the supply-conductor sections at the same time that the other engages the conductive portion of the conduit, as the cover-plates 21. I have shown such contact mechanism in the form of a trolley-wheel 23, mounted upon a shaft 24, supported in the yoke 25 on the lower end of trolley-arm 26, said wheel 23 being adapted to travel in the slot in the top of the conduit, and a pair of trolley-wheels 27, rotatively mounted upon and insulated from the shaft 24 on opposite sides of the trolley-wheel 23 and adapted to contact with the cover-plates 21 of the conduit on opposite sides of said slot, said wheels 27 being provided on the side near the trolley-wheel 23 with a peripheral flange 35, said flanges being adapted to travel in the slot in the top of the tube and prevent contact of the trolley-wheel 23 with the cover-plates 21. The contact-plate 29, secured to an insulating-block 30, mounted in the yoke 25, has arms 31, adapted to bear upon the respective trolley-wheels 27. The trolley-pole or yoke is connected with the positive pole of the motor on the car (not shown) in the usual manner, while the plate 29 is connected with the negative pole of the same by means of the wire 32. The trolley-pole is pivotally mounted upon the car 36, and means is provided, as spring 33, for forcing the trolley-pole downwardly with sufficient force to cause downward flexion of the supply-conductor inclosure such as to bring its sections successively into contact with the supply-conductor sections. The current will thus be taken up by the trolley 23, transmitted to the motor, and returned through the trolley-wheels 27 to the conduit which forms the return-conductor.

It will be seen that the several insulated sections of the inclosure for the supply-conductor are energized only when depressed out of contact with the cover-plates 21 of the conduit and wholly insulated from the conduit. Any known form of contact mechanism may be substituted for the several trolley-wheels 23 and 27.

It will be seen that the supply-conductor sections and the inclosure-sections are readily separable for renewal or repairs, it only being necessary to remove the caps 11 of the splice-box at the opposite ends of a given tube-section 7 to permit the tube-section to be given a partial rotary movement sufficient to bring an unworn portion of the same to the upper side to take the place of the worn portion, and by removing the screws 38, whereby

the ends of the conductor-sections are secured in the yokes 2, the several conductor-sections can be detached, permitting their removal with the inclosing tube-section 7. The caps 11 of the splice-boxes can be easily renewed when necessary or desirable and may be made detachable in any known manner.

The conductor may be supported within the tubular inclosure in any known manner; but I prefer the sectional construction of both the conductor and the inclosing case, as shown.

The conduit may be omitted, if desired, and any known form of contact mechanism be employed for depressing the inclosing case.

What I claim as new, and desire to secure by Letters Patent, is—

1. In an electric-railway system, the combination with a supply-conductor; of a flexible tubular inclosure therefor comprising a series of insulated conductive sections; supports for said conductor extending through transverse apertures in the tubular inclosure wall, and means for yieldingly supporting said inclosure-sections out of contact with said conductor, substantially as described.

2. In an electric-railway system, the combination with a supply-conductor; of a flexible tubular inclosure therefor comprising a series of insulated conductive sections; supports for said conductor extending through transverse apertures in the tubular inclosure wall exteriorly of said inclosure; and springs for yieldingly supporting the inclosure-sections out of contact with said conductor and permitting said sections to be successively forced into contact therewith, substantially as described.

3. In an electric-railway system, a conduit of conductive material adapted to form a return-conductor; a supply-conductor contained therewithin and insulated therefrom; a flexible covering for said supply-conductor made up of sections of conductive material insulated from each other yieldingly supported out of contact with said supply-conductor and adapted to be successively forced into contact therewith while not in contact with the conductive portion of the conduit; in combination with a trolley or the like having parts of different polarity one adapted to contact with the conduit, and the other to contact with the sections of the flexible covering successively and depress them into contact with the supply-conductor.

4. In an electric-railway system, the combination with a plurality of stationary supports; of a plurality of supply-conductor sections detachably secured at their ends to the respective supports and connected thereby in a conductive series; a series of insulated tubular conductive inclosures for the intermediate portions of the respective supply-conductor sections; detachable tubular splice mechanism for connecting together the adjacent ends of the respective inclosure-sections, and a yielding support for the several splice mechanisms, substantially as described.



5. In an electric-railway system, the combination with a plurality of stationary supports, of a plurality of supply-conductor sections detachably secured at their ends to the  
5 respective supports and forming a conductive series; a series of insulated, conductive, tubular inclosures for the intermediate portions of the respective supply-conductor sections; sectional splice-boxes each inclosing a stationary supply-conductor and comprising a  
10 body provided with seats for the neighboring ends of neighboring supply-conductor inclosures; and a detachable cap adapted to clamp said ends in said seats; and yielding supports  
15 for said splice-boxes, substantially as described.

6. In an electric-railway system, the com-

bination with a supply-conductor and fixed supports for the same; of a tube-section inclosing said conductor; a splice-box having  
20 separable clamping members; a splice-bushing projecting from the tube-section and inserted between the members of the splice-box; and an insulating-sleeve inclosing the  
25 inserted portion of the bushing and serving to insulate the tube-section from the splice-box, substantially as described.

In testimony whereof I have hereunto set my hand this 5th day of October, 1901.

FRED A. HOWARTH.

Witnesses:

JOHN J. MCKINLAY,  
ADDISON GIRCK.