

J. H. MUNSON.  
ELECTRIC RAILWAY CONDUIT.

No. 559,105.

Patented Apr. 28, 1896.

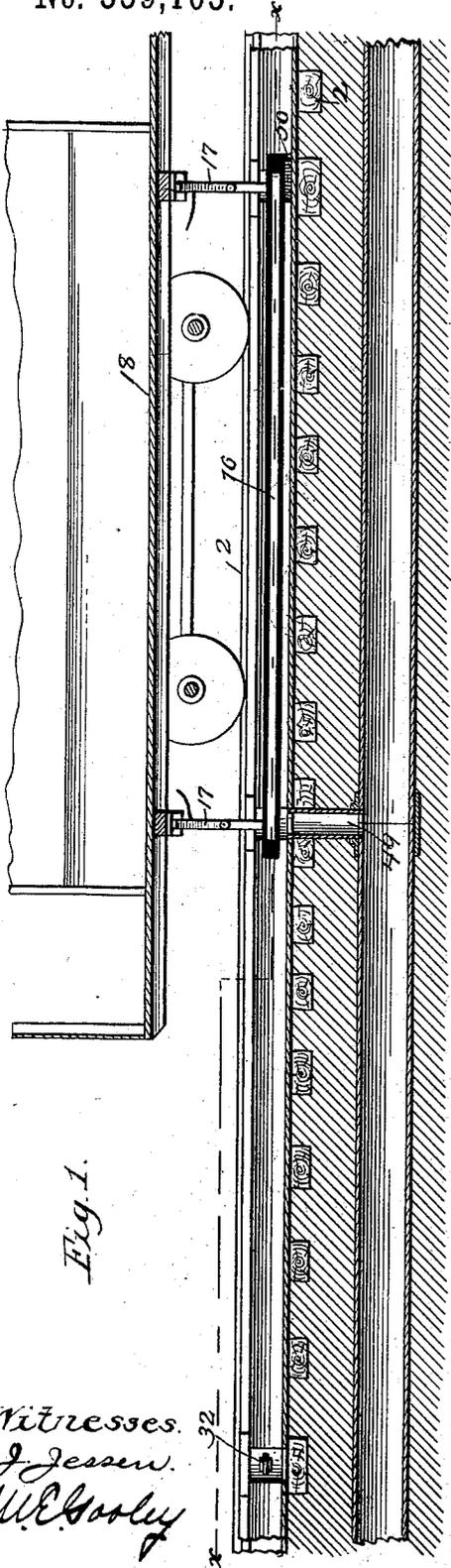


Fig. 1.

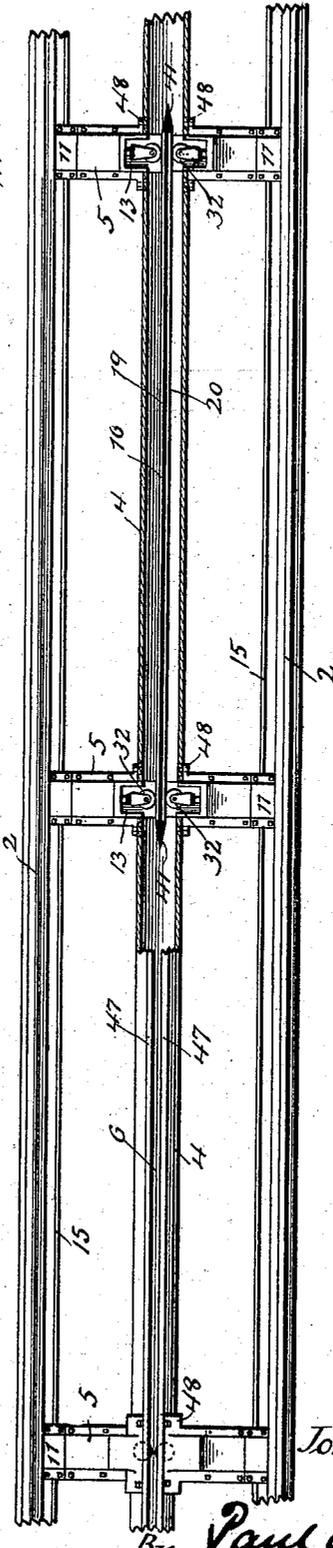


Fig. 2.

Witnesses.  
J. Jessen.  
W. C. Hooley

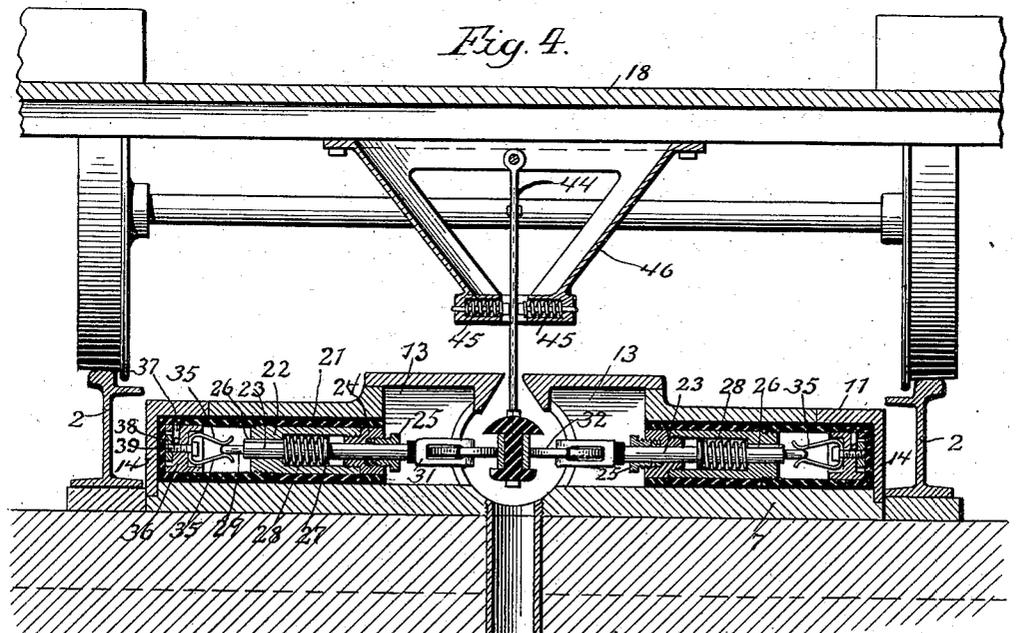
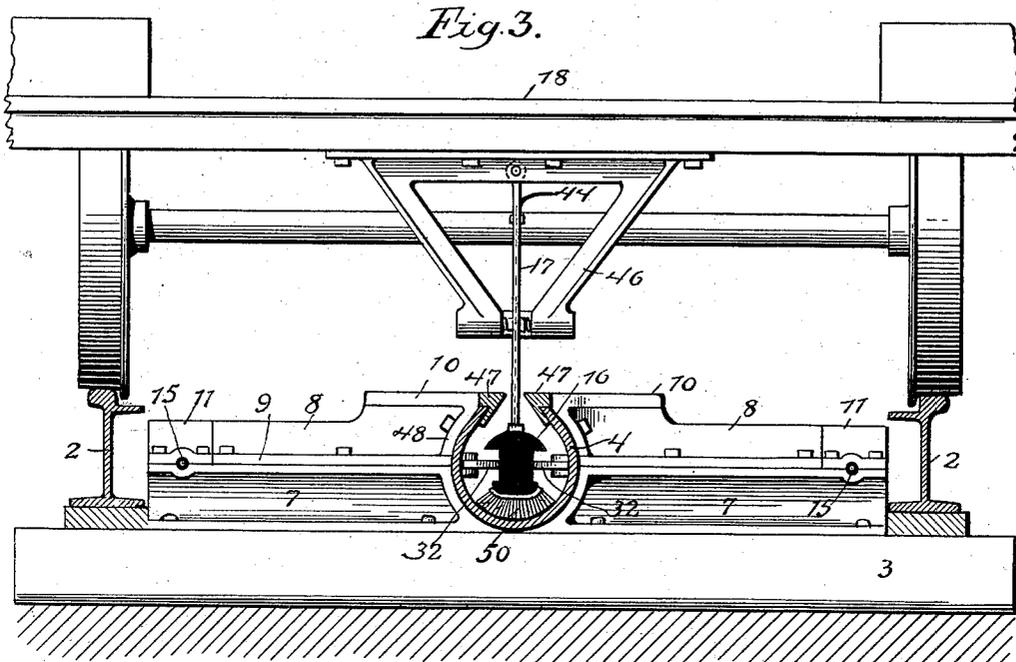
Inventor.  
John H. Munson.

By Paul Otwayley  
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Witnesses.

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(No Model.)

3 Sheets—Sheet 3.

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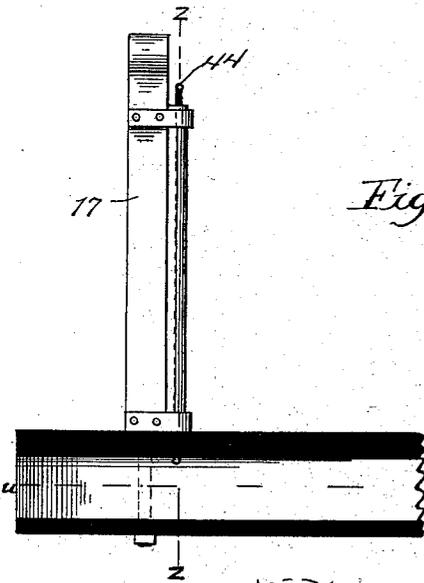
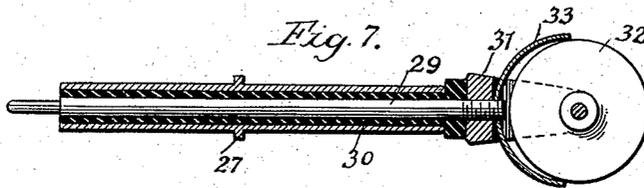
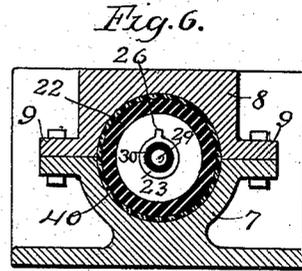
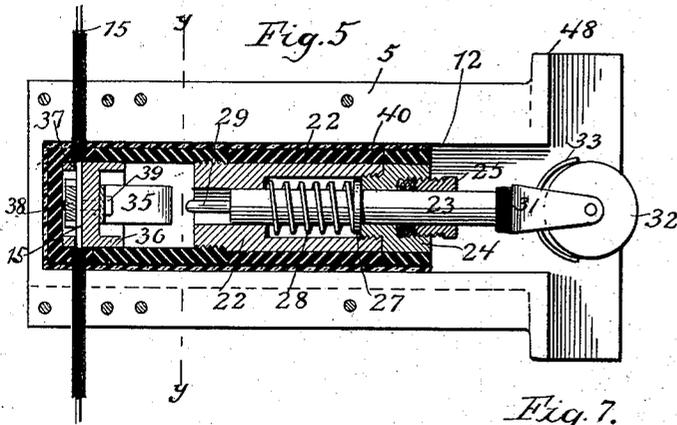


Fig. 8.

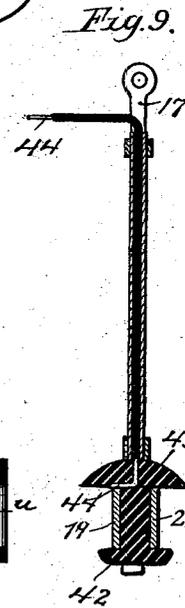
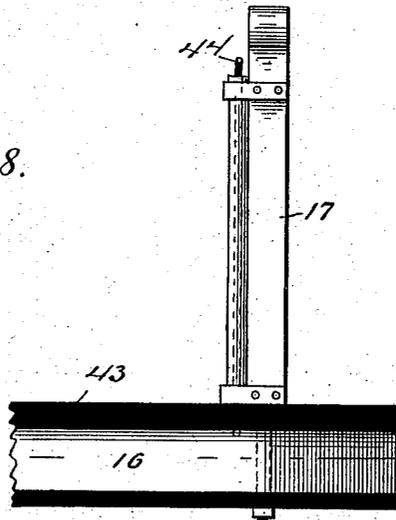


Fig. 9.

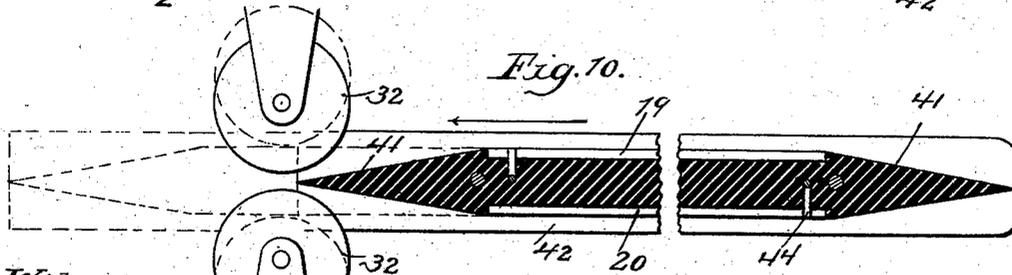


Fig. 10.

Witnesses.

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# UNITED STATES PATENT OFFICE.

JOHN HENRY MUNSON, OF CHICAGO, ILLINOIS, ASSIGNOR OF TWO-THIRDS TO WILLIAM FRANK ROBERTS AND JAMES EDWARD MERRITT, OF SAME PLACE.

## ELECTRIC-RAILWAY CONDUIT.

SPECIFICATION forming part of Letters Patent No. 559,105, dated April 28, 1896.

Application filed March 5, 1895. Serial No. 540,618. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN HENRY MUNSON, of Chicago, Cook county, Illinois, have invented certain new and useful Improvements in Electric Street-Railway Conduits, of which the following is a specification.

My invention relates to underground conduits for electric-railroad or street-railway systems; and the object of my invention is to provide a simple and reliable and durable underground conduit and means for conveying electricity to the cars.

A further object of my invention is to provide a conduit of this class which will be comparatively shallow and which may be kept clean and in good order at very small expense, and, further, to provide a conduit wherein the electric contact or supply parts will be thoroughly durable and thoroughly protected, while at the same time they are "dead" except at moments when a car is passing.

A further object of my invention is to provide a conduit which may be laid or placed in position at a cost very little in excess of the cost of the ordinary track.

A further and most important object of my invention is to provide a conduit which will be practically if not wholly independent of the influences of the atmosphere or moisture.

To these ends my invention consists in a street-railway conduit and electrical connections of the construction and combination of parts all as hereinafter described, and particularly pointed out in the claims.

The invention will be more readily understood by reference to the accompanying drawings, forming part of this specification, and in which—

Figure 1 is a vertical longitudinal section of a track and conduit embodying my invention. Fig. 2 is a plan view of the track and conduit, a portion of the conduit being shown in section to show the collector or contact-shoe, line *x x* of Fig. 1. Fig. 3 is an enlarged transverse vertical section of the track and conduit, the transverse sections or parts of the conduits being shown in full lines. Fig. 4 is a similar view with the section through said transverse parts of the conduit. Fig. 5 is a still further enlarged horizontal section

of one of the transverse parts on the line of the joint between the upper and lower portions thereof. Fig. 6 is a vertical section on the line *y y* of Fig. 5. Fig. 7 is a sectional view of the contact arm or stem. Fig. 8 is a side view of the collector or contact-shoe, the middle part thereof being broken away. Fig. 9 is a vertical section on the line *z z* of Fig. 8. Fig. 10 is a horizontal section of the same on the line *u u*, and showing the relative positions of the opposite contact devices in the conduit.

As shown in the drawings, 2 represents the opposite rails of the track, which rest upon the cross-ties 3, the whole being practically the same as ordinary tracking. It is preferred that all parts of the conduit should lie within the rails and above the ties, and I have so shown the same, though it is obvious that the conduit proper may be made deeper where it is desired or required; but I much prefer to avoid the use of the deep yokes which in such cases ordinarily replace the cheaper ties.

The conduit is made up of the sections 4 and 5. The parts 4 are of sheet-metal or cast-iron pipe, preferably circular in cross-section and having the slots 6 at the top. These sections extend within and are joined to the adjacent or substantially-abutting ends of the transverse sections or parts 5 of the conduit. The last-named parts comprise castings in several pieces, and their construction is shown best in Figs. 3 to 6 of the drawings. These sections 5 are duplicates of one another and the lower and upper edges at the inner ends approach quite closely together. Each is made up of a lower part 7 and an upper part 8, each provided with flanges 9, whereby the same may be secured together by any suitable means, and the upper part carries the street or surface plate 10 and also the heel-plate 11. Within the upper and lower parts is a cylindrical recess 12 of sufficient size to receive the entire contact device and its insulating part. At the inner end this recess is enlarged to form the recess or lateral chamber 13, into which the contact device protrudes. This space is opened by the removal of the top plate 10. The plate 11 has the end part 14, which closes the opening in

the end of the chamber 12 and prevents the contact device from pushing outwardly, and at the same time the plate 11 serves as a binding-block to secure the insulated wire 15, suitable longitudinal grooves being provided in the upper and lower parts of the casting for the purpose.

The electrical connection is made within the insulating-lining of the chamber or recess 12. The form and construction of the contact may to a great extent be varied to suit the conditions in the use of the conduit. Thus, for instance, in high and dry points along the road fewer precautions need be taken to prevent the detrimental effects of moisture, while in all other places I much prefer to employ the construction shown in detail in the drawings. The contact devices or arms project laterally and horizontally into the conduit from the lateral and inclosing parts 5, and, as shown in Figs. 1 and 2, pairs of opposite contacts are placed along the conduit at intervals convenient for use of a long collector or contact-shoe 16, carried by arms or rods 17, depending from the car 18. This shoe or collector is provided with metal strips 19 and 20 upon its opposite sides, the same being insulated from one another and connected, respectively, with the supply and return terminals of the electrical apparatus of the car 18.

The particular construction and the operation of this shoe will be more fully described hereinafter.

In order that the best contact or connection between the arms and the shoe may be insured, it is necessary to so arrange the contact arms or devices that the same will yield slightly when struck by the shoe, opposite arms being spread apart by the same. Further, though it is not wholly essential to my invention, I prefer that this outward movement of the contact-arm shall alone connect the same with the source of electricity, so that the contact device will form a live contact only when the shoe is in engagement therewith. With these points in view the detail construction of the contact devices or arms may be more readily understood. Within the recess 12 I provide a lining 21 of hard rubber, fiber, or other suitable insulating material, preferably in the form of a cap or cover for the binding-post, and which may be quite readily removed to permit access to the same. Within the inner end of this part 21 is the metal cylinder or barrel 22, which carries the slidable arm or stem 23. The end of the barrel 22 is closed by the screw-plug 24, through which the arm 23 operates, a water-tight connection being secured by the small stuffing-box 25 wherever necessary. The stem 23 is prevented from turning by a key or feather 26 thereon, held in a groove in the part 22, and within the barrel 22 the stem has a shoulder 27, against which a coiled spring 28 operates to force the arm toward the conduit

proper. The part 23 is but a sleeve or tube, within which the short conductor-rod 29 is insulated by the filling 30. On the inner end of the rod 29 is the yoke 31, carrying the contact-wheel 32 and insulated from the outer part 23.

33 represents a cleaning-spring pressing against the periphery of the wheel and serving to keep the same bright and clean. The outer end 34 of the part 29 projects beyond the surrounding sleeve 23, and when the arm is forced outward by the entrance of the shoe between opposite contact-wheels this point, connected directly with the contact-wheel, is forced between the contact-springs 35, secured upon the metal binding post or block 36, whereto the conductor-wire 15 is connected. At such times, therefore, a direct connection is made between the supply-wire and the contact-shoe moving within the conduit, or, on the other hand, from the shoe to the return or ground wire. The binding-block or end post 36 has a slot or saw-cut 37 in its upper part, such slot being in line with the grooves in the plate 11 and adapted to receive the short section or bared part of the conductor-wire, which is fastened therein by turning up the nut 38 of the short bolt 39. The insulation is not removed from those parts of the wire outside of the binding-block 36.

The castings which make up the part 5 are not finished on the inside, and therefore to make up for the roughness of the same and to secure the contact devices firmly in place therein I preferably place them in position within the casings 5 and then fill the space about the hard insulation with other insulating material 40 while the same is in a plastic condition.

The contact devices are duplicated on opposite sides and are connected with independent wires 15 15, with a view to using one as a return wire and thus accomplishing a considerable saving of power. The particular construction of the contact-shoe or collector is shown in Figs. 3, 4, 8, 9, and 10. The long metal contact-plates 19 and 20 are secured by suitable means to the sides of the middle part 16 and are insulated therefrom and from one another. The middle part is considerably longer than the contact-plates or strips and terminates in sharp wedge-like ends 41, projecting beyond the plates and strengthened by the upper and lower parts of the shoe. These ends, being of insulated parts or insulating material, remain between the contact-wheels long enough to prevent arcing between the same. That the lower part 42 projects is not essential; but the top 43 of the shoe is much wider than the lower portion, so far overhanging the same as to form a complete water-shed for the contact-plate. The top of the shoe preferably is rounded, so that all dirt and dust will be easily shaken off the same. The carrying-arms 17 project upwardly through the slot of

the conduit, and in line with the same are the conductor-wires 44, leading to opposite terminals of the motor and to opposite plates 19 20.

It will be noted that the contact-plates 19 and 20 are much wider than the faces of the contact-wheels within the conduit, so that the shoe has a free vertical movement of several inches and will not be withdrawn from the contact-wheels by the lifting of the car or through any irregularities in the levels of the rails and the conduit. In addition I preferably hinge or pivot the upper ends of the arms or rods 17 to the car-body or the truck thereof, in order to permit the shoe to follow the slot in the conduit freely. To prevent unnecessary movement, however, I preferably provide the cushions or springs 45 on opposite sides of the arms 17, providing suitable brackets 46 to hold the said springs.

The top of the conduit is preferably finished by the use of edge rails 47, as shown in Figs. 2 and 3, and the same may, if desired, extend across the plates 10; but I prefer to use short sections of these rails instead. To accommodate expansion and contraction, the ends of the pipe-sections 4 should have slot-and-pin fastenings (not particularly shown) in the flanges 48 of the parts 5. As the parts 5 do not necessarily meet, the openings in the bottoms thereof form a convenient means for drain connections 49, as shown in Figs. 1 and 4. Further, the contact-shoe may be removed from the conduit at any point along the road by simply removing opposite surface plates 10. The conduit is kept clean by small brushes 50, attached to the contact-shoes of the several cars.

It is obvious that either one of opposite contact-arms within the conduit may be a simple spring-arm or dummy contact when a return-wire is dispensed with, and, further, that various modifications may be made in the form and construction of the several parts of my conduit without departing from the spirit of my invention, and I therefore do not wish to confine the same to the specific construction shown and described.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In a conduit of the class described, the combination of the slotted pipe-sections, the opposite pairs of lateral parts or extensions whereto the ends of said pipes or sections are secured, said parts or extensions comprising upper and lower portions and surface plates, lateral recesses in said extensions, slidably-arranged contact-arms provided therein and suitably insulated, a circuit-closing device in connection with each arm, a binding block or post in connection therewith and a heel-plate removable to permit access to said binding-block, substantially as described.

2. The combination with a lateral extension of a conduit provided with a suitable recess, a suitable barrel and a binding-block arranged therein and insulated therefrom, con-

tact-springs connected with said block, a contact-arm slidably arranged in said barrel, a spring provided in said barrel to act upon said arm, an insulated part of said arm having an outer end to engage said contact spring or switch, and a contact-wheel horizontally arranged upon the inner end of said insulated part to be engaged by a contact-shoe, substantially as described.

3. The combination, with a lateral extension, of a conduit provided with a suitable recess, a suitable barrel and binding-block arranged therein and insulated therefrom, contact-springs connected with said block, a contact-arm slidably arranged in said barrel, a spring provided in said barrel to act upon said arm, and an insulated part of said arm having an outer end to engage said contact spring or switch, a contact-wheel horizontally arranged upon the inner end of said insulated part to be engaged by said contact-shoe, a water-tight outer end for said recess, and a packing-gland provided about the inner end of the slidable contact-arm and in the head of said barrel, substantially as described.

4. The combination with the track, of the conduit, a contact-shoe or collector movable in said conduit, contact devices provided in said conduit at intervals along the same, said devices arranged in pairs to be operated by the entrance of said shoe between the same, said shoe having an overhanging top or watershed and being of considerably greater width or depth than the faces of said contact devices to permit vertical movement of the shoe, as and for the purpose specified.

5. The combination with a conduit provided with a surface slot, of a contact-shoe or collector movable within the conduit and to be carried by a car, pairs of contact devices arranged within said conduit at intervals along the same and to be engaged by said shoe, said conduit devices being projected outwardly by the shoe, electric feeders or supply-wires, electric switches or circuit-closers connected therewith and arranged in water-tight chambers, said switches or circuit-closers being adapted to be operated by the shoe through the medium of said contact devices, and said circuit-closers being normally out of engagement with said contact devices, and said shoe being of a length to engage two of the pairs of contact devices simultaneously, substantially as described.

6. The combination with the track, of a conduit arranged between the same and having a surface slot, the lateral extensions or containing-boxes projecting upon opposite sides of said conduit, laterally-operative contact devices provided in said extensions or boxes and having suitable bearings therein in which they are adapted to slide, the outer parts of said boxes provided with water-tight chambers, a switch provided in each to be engaged by an insulated part of the contact device when the same is projected outwardly, supply and return connections upon opposite

sides of the conduit, the same connected with respective switches within said boxes, said connections being made water-tight, means to normally project the contact devices inwardly and a movable contact-shoe provided within the conduit to engage said contact devices and whereby circuit is closed, substantially as described.

7. The combination with the track, of the conduit proper, lateral parts or containing-boxes extending from opposite sides of the conduit and having recesses opening into the same, laterally-operative contact and circuit-closing switches provided in said lateral parts or boxes and adapted to be operated by a shoe moving within the conduit, all of said parts being between the rails and above the ties of the track, substantially as described.

8. The lateral extension or containing-box of a slotted conduit having a recess or chamber, an insulating-lining therefor, a metallic lining within the same, a plunger slidable within said metallic lining or barrel, and contact and switch devices provided in connection with said plunger, substantially as described.

9. The lateral extension or containing-box of a slotted conduit having a recess or chamber, an insulating-lining therefor, a metallic lining within the same, a plunger slidable within said metallic lining or barrel, and contact and switch devices provided in connection with said plunger, the ends of said recess being closed by water-tight means, substantially as described.

10. The slotted conduit-sections, in combination with opposite laterally-extending parts whereto the conduit-sections are joined, a collector-shoe to operate within the conduit, and circuit-closing devices provided in said laterally-extending parts and adapted to be operated by said shoe, substantially as described.

11. The combination with the metal pipes forming the conduit-sections and having surface slots, of the pairs of metallic lateral extensions or castings arranged upon opposite sides of the conduit and whereto said sections are joined, the conduit being continued through the same, said lateral extensions or castings provided with cavities or recesses, circuit-closers provided therein, and a shoe to travel in the conduit and to actuate the circuit-closers, substantially as described.

12. The combination with the conduit-sections having surface slots, of the horizontal lateral extensions upon opposite sides of the conduit, said extensions being metallic and provided with recesses which at their inner ends open into the conduit and are closed at their outer ends, supply and return conductors having insulated terminals within the outer ends of opposite extensions, laterally-operative contact devices provided within said extensions, the same having their inner ends projecting into the conduit, surface plates upon the inner and outer ends of each lateral extension and upon the removal of

which access may be had to said contact devices and to said terminals, and a shoe movable in the conduit and adapted to project said contact devices, which when so projected make electrical connections with said terminals, substantially as described.

13. The combination with the conduit having a surface slot, of metallic lateral extensions through which the conduit and slot are continued, a shoe or collector to operate within the conduit, and circuit-closers provided in said lateral extensions, each said circuit-closer comprising a plunger laterally operative in metallic bearings in the lateral extension, a conductor insulated within the plunger, a contact-wheel wherewith the conductor is connected, said wheel being carried by said plunger but insulated therefrom, means for returning the plunger inwardly, and an electric circuit-closer or switch proper provided in the outer end of the lateral extension and by means of which circuit is closed through said conductor and wheel when said parts are projected outwardly by said shoe, substantially as described.

14. The combination with a slotted conduit, of laterally-operative contact devices arranged therein at intervals along the same and adapted to be actuated by a collector or shoe, each said contact device comprising a reciprocating plunger held in suitable metallic bearings, a conductor insulated within said plunger, a contact-wheel connected with said conductor at the inner end thereof, said wheel being carried by said plunger but insulated therefrom, means to prevent rotation of the plunger in its bearings, a water-tight chamber at the outer end of said plunger, electric terminals or switches provided therein to be engaged by said conductor when the same is projected outwardly by the contact of the shoe with said wheel, substantially as described.

15. The combination with the slotted conduit, of the metallic lateral extensions or parts, each having a recess opening into the conduit, a metallic plunger having metallic bearings within each extension, a contact-wheel carried upon the outer end of said plunger but insulated therefrom, a conductor extending from the wheel through said plunger and insulated therefrom, a contact provided upon the outer end of said plunger, a chamber in the outer end of said extension, a switch provided therein, an electric conductor or feed-wire, and means whereby the same is connected to the switch within the said extension, substantially as described.

16. The combination with the slotted conduit, of the metallic lateral extensions or parts, each having a recess opening into the conduit, a metallic plunger having metallic bearings within each extension, a contact-wheel carried upon the outer end of said plunger, a chamber in the outer end of said extension, a switch provided therein, an electric conductor or feed-wire, means whereby the same is connected to the switch within

the said extension, and removable surface plates upon each extension, upon the removal of which access may be had to said contact-wheel, to said switch and to the electrical connections.

17. The combination with the conduit, of the metallic lateral extensions or parts, the plunger laterally operative therein, contact devices insulated from the plunger and at opposite ends thereof, said devices being connected, a shoe to travel within the conduit to engage the inner contact device, the electrical connections provided in the outer end of the lateral extension, two springs forming the terminal thereof, and the outer contact device carried by said plunger adapted to enter between said springs, said connections and said springs being wholly insulated from said lateral extension and part, substantially as described.

18. The combination with the slotted conduit, of metallic lateral extensions thereof, each extension being provided with a chamber or recess, a plunger having metallic bearings therein in which the same is adapted to operate laterally with respect to the conduit, a contact-wheel and a conductor carried by said plunger and insulated therefrom, a water-tight chamber in the outer end of the extension, contact-springs provided therein, means for connecting electric wire thereto, said springs being supported in a body of insulating material and thereby insulated from surrounding parts, and the outer end of said conductor adapted to engage said springs when the plunger is projected outwardly, substantially as described.

19. The combination with the metallic lateral extension of a slotted conduit, of an open-ended chamber or cylinder provided therein, a metallic plunger, thereby provided with bearings at its opposite ends, the inner portion of said chamber or cylinder being enlarged between said bearings, a contact-wheel carried by said plunger, a conductor extending through the plunger, said conductor and wheel both insulated from the plunger, means to prevent the rotation of the plunger, and a water-tight chamber provided in the outer end of said extension, and a switch device provided therein to engage an extension of said conductor, substantially as described.

20. The combination with the metallic lateral extension of a slotted conduit, of an open-ended chamber or cylinder provided therein, a metallic plunger thereby provided with bearings at its opposite ends, the inner portion of said chamber or cylinder being enlarged between said bearings, a contact-wheel carried by said plunger, a conductor extending through the plunger, said conductor and wheel both insulated from the plunger, means to prevent the rotation of the plunger, and a water-tight chamber provided in the outer end of said extension, and a switch device provided therein to engage an extension of said conductor, and means to prevent the en-

trance of moisture to the switch-chamber through the plunger-chamber, substantially as described.

21. A contact-shoe for employment in a slotted conduit, said shoe comprising a body of insulating material, the same being of considerable length and provided with sharp, wedge-like ends 41, and oppositely-arranged contact-plates of equal length provided upon the sides of said body, substantially as described.

22. A contact-shoe for employment in a slotted conduit, said shoe comprising a body of insulating material, the same being of considerable length and provided with sharp, wedge-like ends 41, contact-plates of equal length provided upon the sides of said body, said plates being arranged opposite one another upon opposite sides of the body of insulating material, and horizontal strengthening-ribs provided upon the upper and lower edges of said body, substantially as described.

23. A contact-shoe for employment in a slotted conduit, said shoe comprising a body of insulating material, the same being of considerable length and provided with sharp-pointed or wedge-like ends 41, a contact plate or plates provided upon one or both sides of said body, horizontal strengthening-ribs provided upon the upper and lower edges of said body, and the upper rib provided with convex top, as and for the purpose specified.

24. The combination in a circuit-closer to be actuated by a traveling shoe, of a metallic plunger or tube, a conductor provided therein and having an end to engage said switch, a contact-wheel carried upon the outer end of said conductor, bearings for said plunger, the inner surface of said plunger and the surface of said conductor being rough and a compressed filling of insulating material between said parts whereby the same are locked together and the conductor insulated from the plunger, substantially as described.

25. The combination with the lateral projection of an underground conduit, of a contact-wheel to be engaged by a contact-shoe, a horizontally and laterally movable plunger whereby said wheel is carried and from which the same is insulated, a conductor extending through said plunger, a water-tight chamber provided at the outer end of said plunger and containing a switch to be engaged by said conductor, and bearings intermediate between said chamber and the inner end of said plunger, said bearings being distant from one another and separated by a chamber, substantially as described.

26. The combination with the lateral projection of an underground conduit, of a contact-wheel to be engaged by a contact-shoe, a horizontally and laterally movable plunger whereby said wheel is carried and from which the same is insulated, a conductor extending through said plunger, a water-tight chamber provided at the outer end of said plunger and containing a switch to be engaged by said con-

ductor, bearings intermediate between said chamber and the inner end of said plunger, said bearings being distant from one another and separated by a chamber, and a spring provided in said chamber to act upon said plunger, substantially as described.

27. The combination with the slotted conduit, of lateral extensions, said extensions comprising lower parts 7 and upper parts 8, said lower parts having broad flanges or bases, means for securing said parts together, a chamber or recess within each lateral extension so formed, longitudinal flanges provided upon said extensions at their inner ends to facilitate joining the same with the conduit-sections, removable surface plates and circuit-closing and switch devices provided in each said lateral extension, substantially as described.

28. The combination with the slotted conduit, of lateral extensions, said extensions comprising lower parts 7 and upper parts 8, said lower parts having broad flanges or bases, means for securing said parts together, a chamber or recess within each lateral extension so formed, longitudinal flanges provided upon said extensions at their inner ends to facilitate joining the same with the conduit-sections, removable surface plates, a removable heel-plate 11 provided with a depending part forming the outer end of the lateral extension, circuit-closing and switch devices provided in each lateral extension, the same being normally insulated from one another and at all times insulated from the extension or containing-box, substantially as described.

29. The combination with a conduit having lateral extensions, of laterally-operative circuit-closing devices provided therein and

adapted to be operated by a moving shoe, a switch device provided in the lateral extension and wherewith the contact device is adapted to be engaged, electrical connections with said switch device, and said switch device and said connections being entirely inclosed in hard insulating material with the exception of the part to be engaged by said contact device, substantially as described.

30. The combination with a slotted conduit, of a shoe to move therein, laterally-operative contact devices to be engaged by said shoe, means whereby circuit is closed through said contact devices when the same are projected outwardly, each said contact device comprising a plunger, a conductor insulated within the same, a yoke secured upon the end of said conductor and also insulated from said plunger, and a contact-wheel arranged in said yoke, substantially as described.

31. The combination with a slotted conduit, of a shoe to move therein, laterally-operative contact devices to be engaged by said shoe, means whereby circuit is closed through said contact devices when the same are projected outwardly, each said contact device comprising a plunger, a conductor insulated within the same, a yoke secured upon the end of said conductor and also insulated from said plunger, a contact-wheel arranged in said yoke, and a spring 33 interposed between the yoke and said wheel, as and for the purpose specified.

In testimony whereof I have hereunto set my hand this 1st day of March, A. D. 1895.

JOHN HENRY MUNSON.

In presence of—

C. G. HAWLEY,  
M. E. GOOLEY.