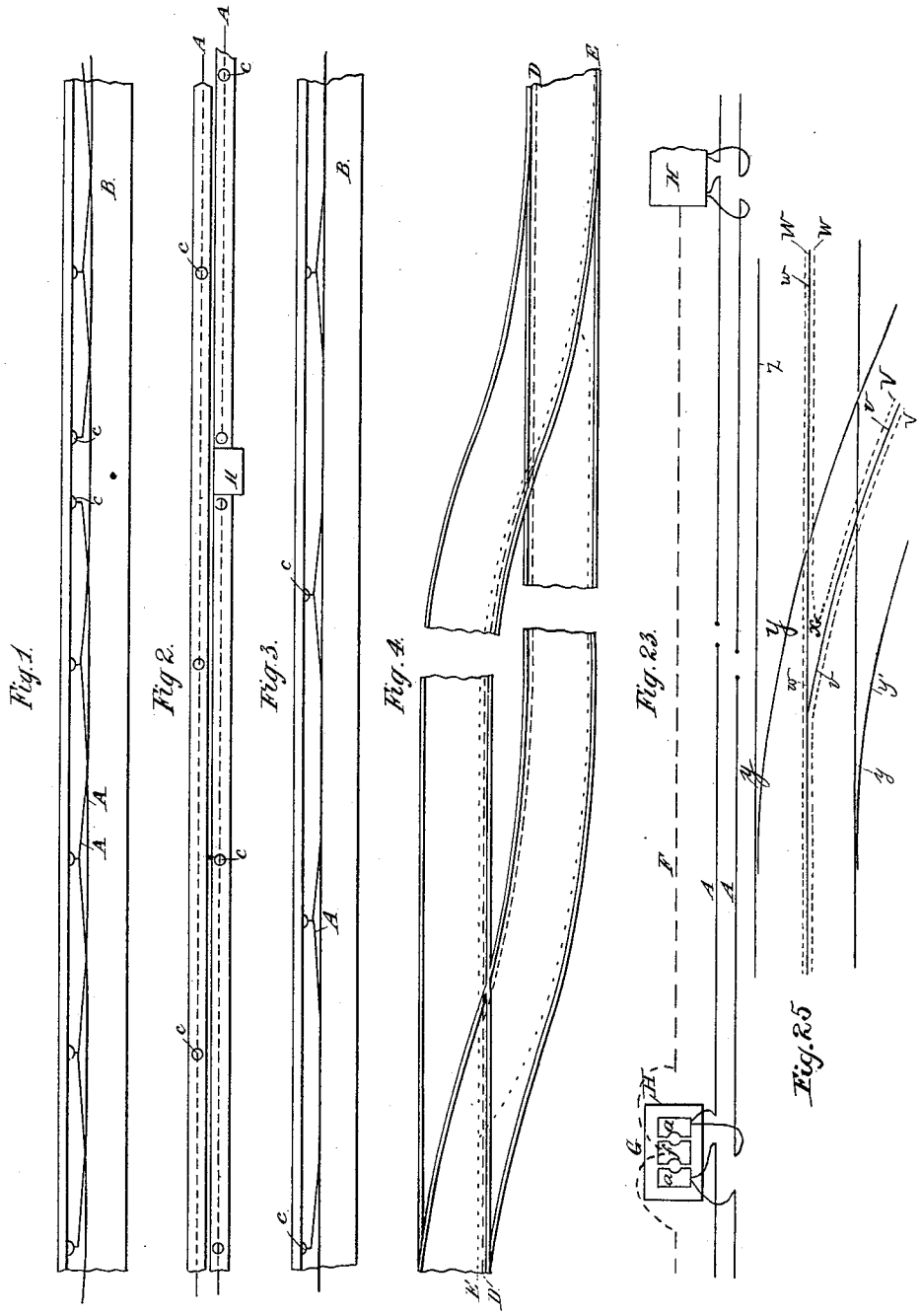
(No Model.)

4 Sheets—Sheet 1.

M. H. SMITH.

ELECTRIC TRAMWAY.

No. 394,621. Patented Dec. 18, 1888.



Witnesses.
Philip M. Justice
Allen Jones

Inventor.
M. Holroyd Smith

(No Model.) 4 Sheets—Sheet 2.

M. H. SMITH.

ELECTRIC TRAMWAY.

No. 394,621. Patented Dec. 18, 1888.

Fig 5

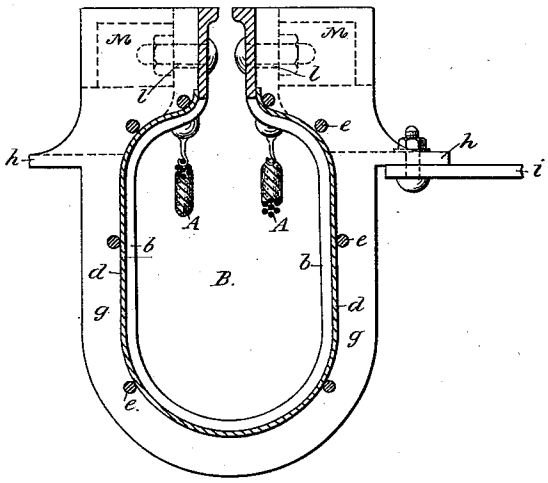


Fig. 6.

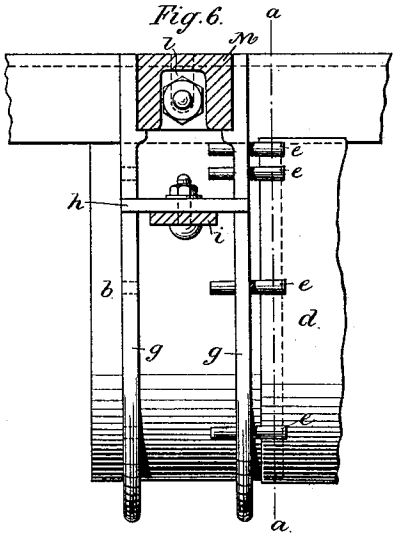


Fig. 8.

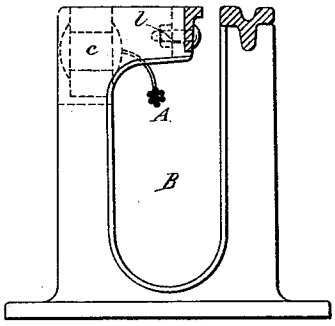


Fig. 7.

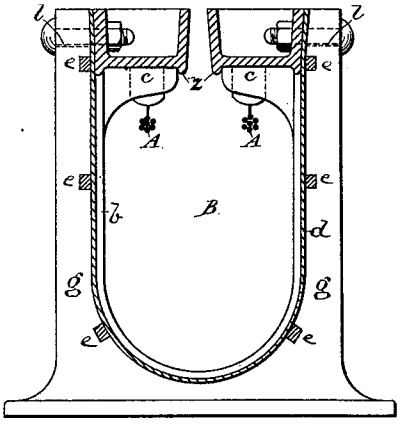


Fig. 9.

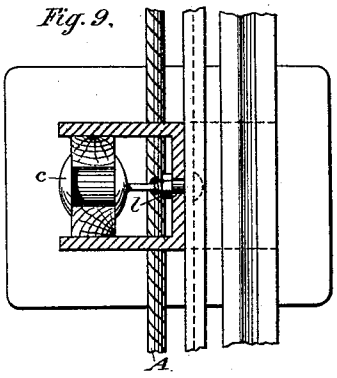
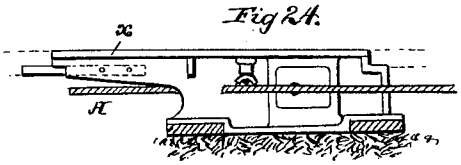


Fig 24.



Witnesses.

Philip M. Inskeep

Allen C. Jones

Inventor.

M. Holroyd Smith.

(No Model.)

4 Sheets—Sheet 3.

M. H. SMITH.

ELECTRIC TRAMWAY.

No. 394,621. Patented Dec. 18, 1888.

Fig. 15.

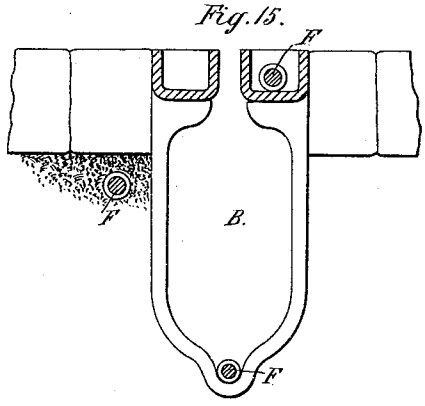


Fig. 17.

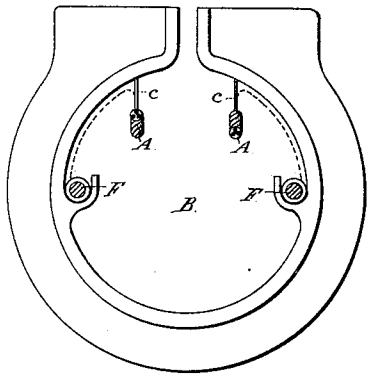


Fig. 13.

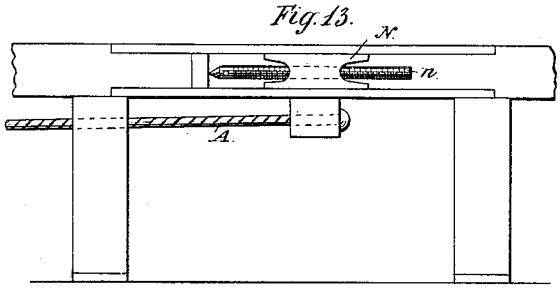


Fig. 14.

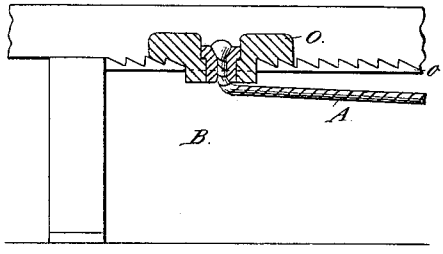


Fig. 10.

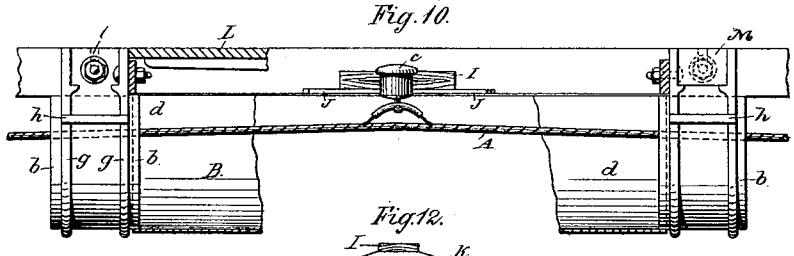


Fig. 12.

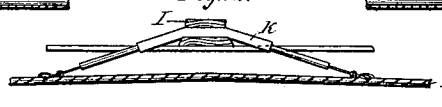
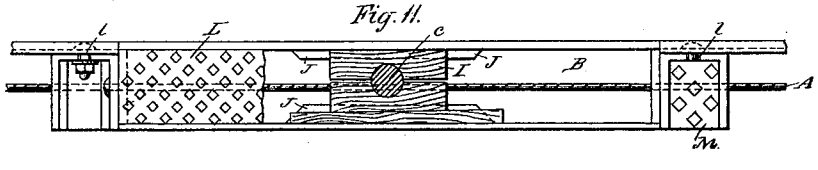


Fig. 11.



Witnesses.

Philip A. Joshee

Allen G. Jones

Inventor

M. Hobroyd Smith.

(No Model.) 4 Sheets—Sheet 4.

M. H. SMITH.

ELECTRIC TRAMWAY.

No. 394,621. Patented Dec. 18, 1888.

Fig. 22.

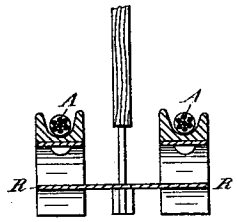


Fig. 21.

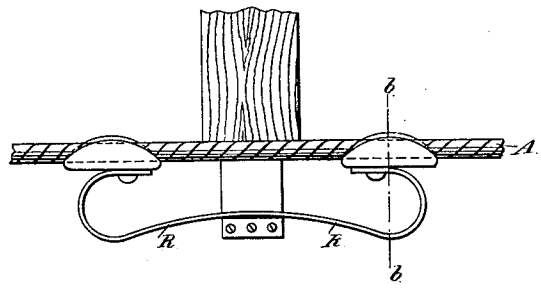


Fig. 16.

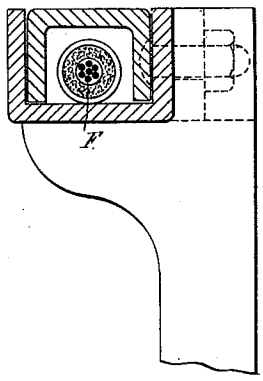


Fig. 20.

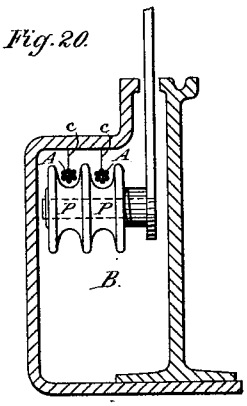


Fig. 18.

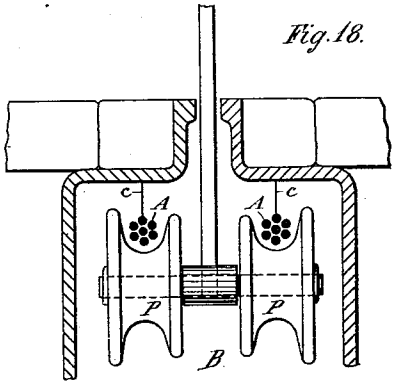
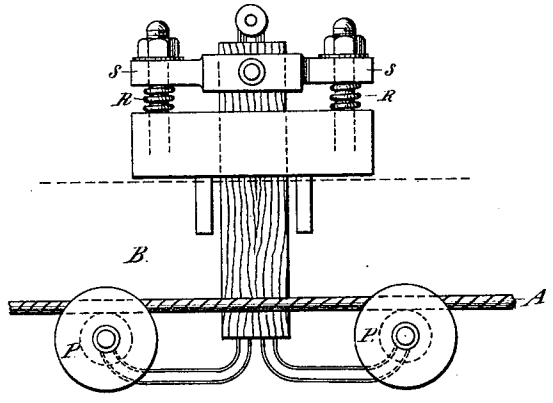


Fig. 19.



Witnesses.
Philip W. Justice
Allen Jones

Inventor.
M. Holroyd Smith.

UNITED STATES PATENT OFFICE.

MICHAEL HOLROYD SMITH, OF HALIFAX, COUNTY OF YORK, ENGLAND.

ELECTRIC TRAMWAY.

SPECIFICATION forming part of Letters Patent No. 394,621, dated December 18, 1888.

Application filed May 4, 1886. Serial No. 201,085. (No model.) Patented in England May 7, 1885, No. 5,627; in France April 23, 1886, No. 175,705; in Belgium April 24, 1886, No. 72,874; in Germany April 28, 1886, No. 40,497, and in Italy June 12, 1886, XX, 19,887.

To all whom it may concern:

Be it known that I, MICHAEL HOLROYD SMITH, a subject of Her Majesty the Queen of Great Britain, residing at Halifax, in the county of York, England, have invented a certain new and useful Improvement in and connected with Electric Tramway or Railway Systems, (the same having been described and patented to me in part in Great Britain under Letters Patent No. 5,627, dated May 7, 1885; in Belgium under Letters Patent No. 72,874, dated April 24, 1886; in France under Letters Patent No. 175,705, dated April 23, 1886; in Germany under Letters Patent No. 40,497, dated April 28, 1886, and in Italy under Letters Patent No. 19,887, Vol. 20, dated June 12, 1886,) of which the following is a specification.

This invention relates to improvements in and connected with the transmission of electric currents for electric tramway or railway systems, as also to the apparatus by which said currents may be collected from the conductors and transmitted to the motor in the car.

The invention consists in an improved form of conductor supported in a channel, preferably of the construction hereinafter described, as also in the construction of said channel and its connected parts, and in the arrangement of parts whereby the currents are collected from the conductors and transmitted to the car or motor, all as hereinafter more fully set forth.

To clearly describe my invention, reference is made to the accompanying drawings, which form part of this specification, and in which—

Figure 1 is a sectional elevation of a central channel, showing two suspended conductors. Fig. 2 is a top view of Fig. 1. Fig. 3 is a sectional elevation of a channel having a single suspended conductor. Fig. 4 illustrates a passing-place or turn-out for a single line when a combined rail and channel is employed, as will be hereinafter described. Fig. 5 is an enlarged cross-section of a channel carrying two conductors, the section being taken on the line *a a* of Fig. 6, which is a side elevation of same. Fig. 7 is a like cross-section of a modified form of channel. Fig. 8 is a cross-section of a combined channel and rail wherein a single conductor is employed. Fig. 9 is a plan view of Fig. 8, partly in section. Fig. 10 is an elevation, partly in section and broken away, of the channel, showing the insulated support employed for suspending the conductors and the cap or cover of the channel. Fig. 11 is a plan view of same. Fig. 12 is a modified form of insulated support for the conductors. Figs. 13 and 14 show alternative devices for securing and tightening the suspended conductors. Figs. 15, 16, and 17 show two channels and an enlarged portion of a third for the purpose of showing various relative positions of the insulated main cables. Figs. 18, 19, and 20 show forms of roller collectors for collecting the current to be transmitted to the motor on the car. Fig. 21 is a side elevation of a skid or shoe collector which is pressed against the conductor by a flat spring. Fig. 22 is an end view in section of same on the line *b b*. Fig. 23 is a diagrammatic view showing the insulated main cable, exposed conductors, and controlling-switches. Fig. 24 is a side view of plate or casting at one of the channel points or angles of a turn-out or branch of the road, a conductor of the main line being shown on the farther side and a conductor of the branch on the near side. Fig. 25 is a diagrammatic plan view illustrating a turn-out in a road provided with a central conductor-channel.

In all the figures like letters of reference are used to designate like parts.

The underground conductors heretofore employed have usually consisted of more or less rigid rods or sections of metal of various shapes. I have found, however, that a suspended rope or cable may be successfully employed when properly insulated and supported in a suitable channel, as will be hereinafter described.

Two conductors, A A, are preferably employed suspended at intervals of their length in the channel B (see Figs. 1 and 2) by their insulated supports or holders. I consider it preferable to suspend the conductors alter-

nately at points on opposite sides of the channel (see Fig. 2) in order to secure constant contact and pressure of the collectors traveling against them, for, while a collector is passing the suspended point of one conductor its contact must necessarily be light to avoid any risk of fouling; but on the other side the rope will be hanging with its full weight upon the other collector or collectors, thus insuring perfect contact.

When one conductor is employed, as shown in Fig. 3, it may be placed in a channel the groove of which runs by the side of the tram-rail, the latter forming one side of the groove, as shown in Figs. 8 and 20, while the other side of the groove is formed by the edge of an overhanging portion of the channel, under which portion is suspended the conductor or conductors A. By these means I obtain a firm central support for the said rail and provide ample protection for the conductors; but in this arrangement it is necessary to employ a special construction of tramway, as otherwise difficulty would be experienced at the "points" or those places where turn-outs, side tracks, or switch-rails leave the main-line rails, as it is desirable that the angle at which such turn-outs or switch-rails diverge from the main rails and the angle at which the corresponding channel for the conductor leaves the main channel should not coincide. The reason for this is that the angles at which the rails of the turn-outs leave the rails of the main line should be as fine as possible, so as to avoid the disagreeable strains, joltings, and swaying of the cars when such places are passed by trains traveling at a high rate of speed. At such turn-outs there must also be turn-outs or branches in the conductor-channels, and the area of cross-section of the conductor-channel must be maintained. This would necessitate, were the diverging channels parallel with the diverging rails, that the metallic plate ordinarily employed to cover the channels must be extended to form a long and narrow tapering tongue of metal, *x*, (see Fig. 24,) between the diverging channels, which tongue of metal it is difficult or impracticable to support. Such a construction is open to serious mechanical disadvantages, since these long tapering and unsupported tongues of metal are in constant danger of breakage, especially from the passage thereover of heavy teams. It therefore follows that for a successful road, combining ease of travel with structural strength, the rail points or angles of divergence must be fine, while the conductor points or angles of divergence are wider or less acute. Two alternative constructions combining these two features are illustrated in Fig. 4, wherein the broken line D D represents one form of channel and the dotted line E E another.

If the channel D be observed, it will be noticed that, instead of following the rail which it followed along the main line, it changes sides at the point of the crossing, following the rail on the opposite side of the track, so that the angle of divergence of the channels is less acute than the angle of divergence of the rails with the attending advantages herein referred to. On the other hand, while the channel lettered E does not change sides as does the one D, it is yet not parallel with the rail adjacent to which it lies on the main lines, as it follows the turn-out rail a short distance where it branches, one channel following the main line and the other the turn-out, the angle at such branch or point being less acute than is that of the rail. This changing of position of the collector-channel relative to the rail necessitates that the collector carried by the car should have a lateral shifting movement relative thereto in order that it may follow the channel.

In Fig. 25 I have shown in diagrammatic plan view a track and turn-out provided with a central conductor-channel, which more clearly illustrates the differences in the angles (lettered *y*) between the rails and the angles (lettered *w*) between the conductor than do the constructions shown in Fig. 4. From an examination of this figure it will be seen that the overhanging tongue of metal, *x*, of the covering-plate of the channel, which lies between the two conductor-channels at the point *w*, where they branch, and which forms the covering therefor between the two channels before they have so far separated as to permit separate covering-plates being used, is much shorter than it would be did the branch channel V leave the main channel W at the same angle the branch tracks Y leave the main tracks Z. It will be understood that the dotted lines V W in this figure indicate the channels and the full lines *v w* between them the slits for the passage of the collectors. The connections between the car and the collector should permit a lateral movement of the collector, so that it may follow the channel at the crossings.

The electric current to conductors A may be supplied by any of the well-known means, and may be passed directly from the generating source to said conductors, or may be carried along the line by suitable insulated electric cables, F, as shown in Figs. 15, 16, 17, and 23, which are "tapped" at intervals and connected with the exposed conductors A, with which they may be connected or disconnected by the switch G, Fig. 23, which is placed as shown, in order that it may control two sections of the line. In this construction the terminal *f* is connected with the electric cable F, while terminals *a a* are connected by insulated wires with the exposed conductors A, the switch being contained in boxes H, provided with removable covers.

The cables F may be laid in any convenient position; but preference is given to such points as will render them readily accessible, such as those indicated in Figs. 16 and 17. In Fig. 16 the conductor F rests within a trough at one side of the channel and is pro-

tected by a suitable cover, and in Fig. 17 the conductor or conductors F are supported by a trough within the channel.

The conductor F may also be placed in any one of the three positions shown in Fig. 15, where the channel is shown provided at its bottom with a suitable trough, in which may lie the conductor, or the conductor may be in a separate trench to one side of the channel B; or, again, it may be in one or the other of the gutter-troughs formed in the cover of the channel.

The exposed conductors may be very conveniently suspended in the channel by means of wooden blocks I, which rest on projecting ribs J of the iron forming the channel, as shown in Figs. 10 and 11, in which the wooden blocks I are so wedged as to grip the neck of the porcelain or other insulator, *c*, which is provided with a hook or other contrivance for attachment to the conductor; or, when desired, the rigid insulator *c* may be omitted and the conductor be suspended by means of a strong and well-insulated band, K, as shown in Fig. 12.

For the purpose of obtaining easy access to the channels and their contained conductors and supports, the covers L are made in lengths and are laid so as to be readily removable.

The construction of the channels themselves may be conveniently effected, as shown in Figs. 5, 6, 7, and 10, where the chair-sections are used as the foundation, the outer faces being provided with ribs or flanges *b*, around which are bent metal plates *d*, filling the space between chair and chair. Plates *d* are secured in position by means of pins or cotters *e*, Figs. 5, 6, and 7, which pass through holes in the webs *g* of the chair. The edges of the plates *d* being held against the metals forming the surface of the road, all extraneous matter is excluded from the channel.

The wings *h*, Figs. 5 and 6, are employed as a means of attachment to the rail tie-bar *i*, as shown.

In order to prevent the water from running down the sides of the channel, and consequently moistening the surface of the insulators, causing electric leakage from the conductor to the conduit, I provide the surface-cover or the portions thereof adjacent to the slot with projections *z*, Fig. 7, forming lips extending into the conduit, and which will cause the water running through the slot to collect on such lips and drip clear of the conductors to the base of the conduit.

In order to facilitate the fixing and removal of the metal forming the surface of the channel, the bolt-hole in each chair is made with an upward slot, *l*, as shown in Figs. 5, 6, 7, 8, 9, 10, and 11, so that by slackening the nuts the metal section and bolts may be lifted out together, while when fixed in position the nut is protected and locked in place by means of a removable cap or covering, M, Figs. 5, 6, 10, and 11.

Means for securing the ends and tightening or taking up the slack of the conductors A are shown in Figs. 13 and 14—in Fig. 13 by means of a block, N, and screw *n*, and in Fig. 14 by means of a block O, provided with teeth engaging with the rack *o*.

Collectors adapted to work with the improved conductors, as described, are represented in Figs. 18, 19, 20, 21, and 22. The forms shown in Figs. 18, 19, and 20 show how revolving grooved wheels P may be employed as contact-makers, while Figs. 21 and 22 show grooved skids or gliding contacts collecting from the under side of the conductors. In these constructions, wherein two conductors forming a single limb of the circuit are employed for the purpose hereinbefore described, the collector has a separate contact device for each conductor, whereby the necessary flexibility of the attachments may be secured by the use of springs R, which may be either within the channel, as shown in Figs. 21 and 22, or without the channel, as shown in Fig. 19, where the rise and fall of the contact-makers is controlled by the greater or less pressure of cross-bar S upon springs R, this construction being also applicable to overhead contact-makers.

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

1. In electric tramway or railway systems, the combination, with a channel, of a flexible conductor suspended therein and a collector adapted to travel within the channel and make contact with the conductor, substantially as described.

2. In electric tramway or railway systems, the combination, with a channel, of flexible conductors suspended therein at alternately-opposite points, substantially as described.

3. In electric tramway or railway systems, the combination, with a channel, of a flexible conductor therein and suspensory insulators connected to the conductor, substantially as described.

4. In electric tramway or railway systems, the combination, with the channel and a flexible conductor, of a collector having flexible attachments between the contact devices and the car, substantially as and for the purpose specified.

5. In electric tramway or railway systems, the combination, with a main insulated conductor and exposed conductors, of a channel containing the exposed conductors and provided with a trough for receiving the main insulated conductor, substantially as described.

6. In electric tramway or railway systems, the combination, with a main insulated conductor, of a channel provided in its upper portion with an easily-accessible open trough for the reception of the said conductor and a removable cover for said trough, substantially as described.

7. In electric tramway or railway systems, the combination, with a tram-rail, of a channel formed with a groove, one side of which is

a support or web directly under the rail which lies adjacent to the groove, and the other side being provided with an overhanging flange, below which are placed the conductors, substantially as described.

8. In electric tramway or railway systems, a channel consisting of a main or body portion provided at intervals with slots at the upper edge, and a removable surface or cover portion provided with bolts adapted to enter the said slots, and a removable cap for protecting the bolts, substantially as described.

9. The combination, with a channel having ribs or projections, of blocks supported thereby, an insulator supported by the blocks, and means for causing the blocks to clamp the insulator between them, substantially as described.

10. In a turn-out of an electric railway, the combination of the main rails and the main conductor-channel and the diverging rails and the diverging conductor-channels, the angles at which the conductor-channels diverge being less acute than the angles at which the rails diverge, substantially as and for the purpose set forth.

11. In an electric tramway or railway system, a channel consisting of chair-sections having perforated ribs or flanges, sheet-metal plates bent to fill the space between the chairs, and pins passing through the perforations in the flanges and serving to secure the sheet-metal plates in place, substantially as described.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

MICHAEL HOLROYD SMITH.

Witnesses:
PHILIP M. JUSTICE,
ALLEN P. JONES.