(No Model.) 2 Sheets—Sheet 1.

M. J. WIGHTMAN.

TROLLEY FOR ELECTRIC RAILWAYS.

No. 448,172. Patented Mar. 10, 1891.

Fig. 1.

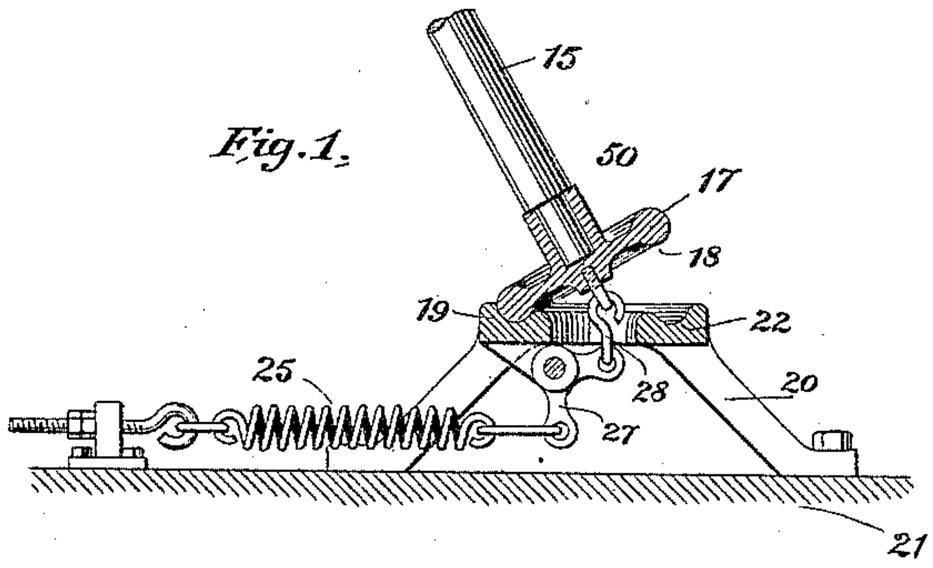


Fig. 2.

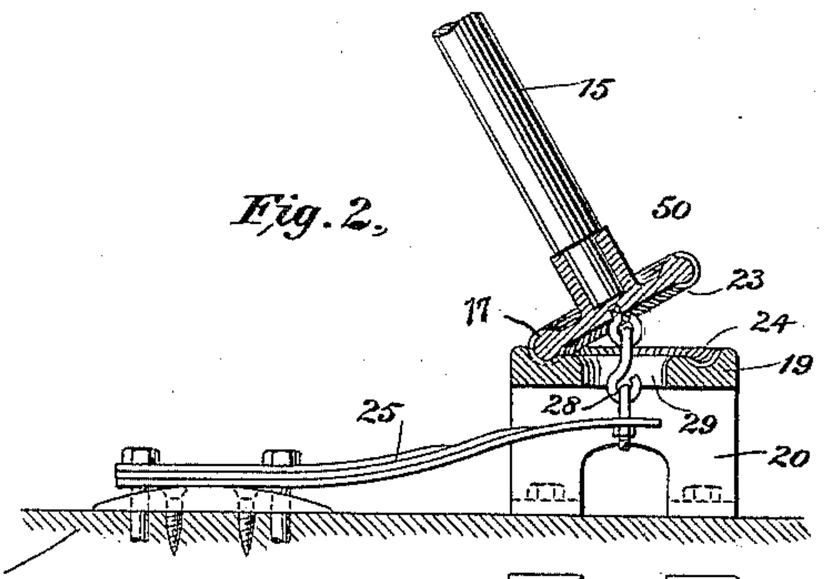


Fig. 3.

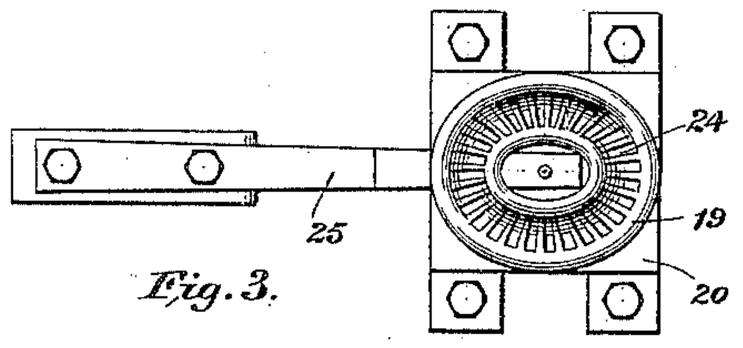


Fig. 4.

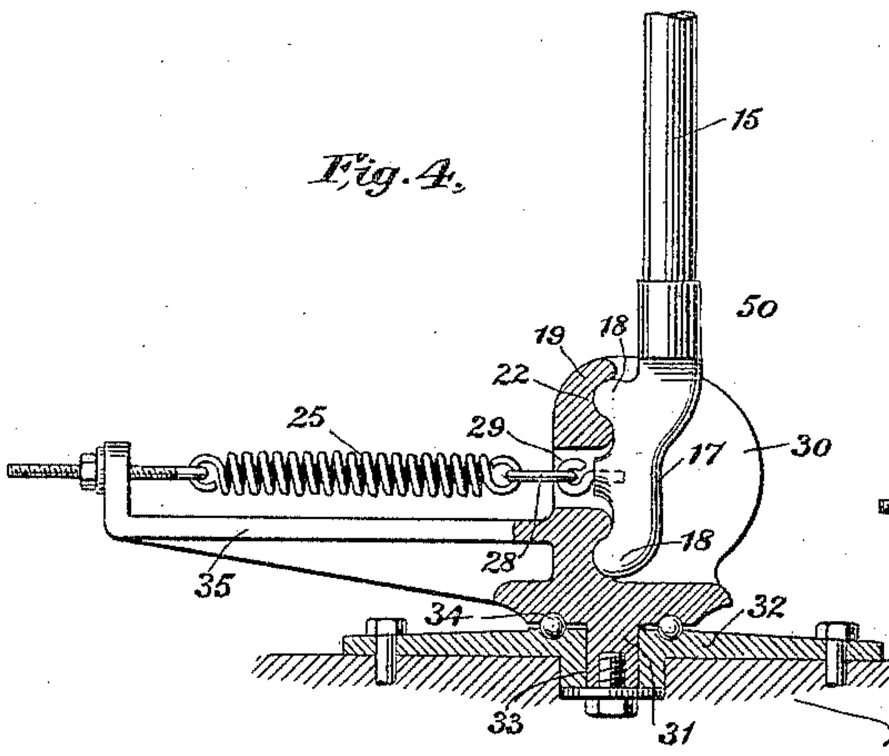


Fig. 5.

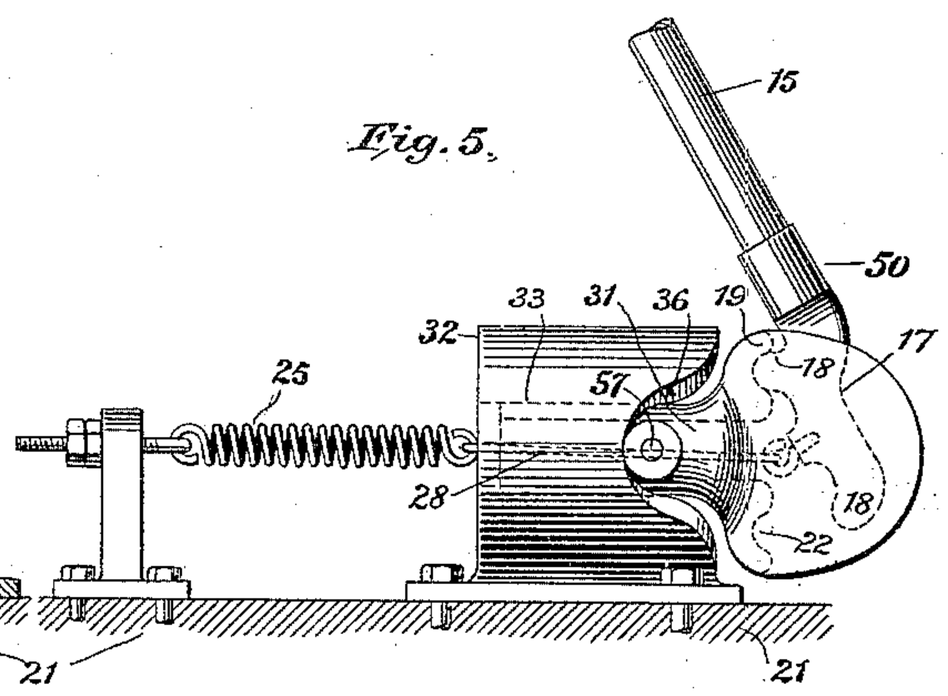


Fig. 6.

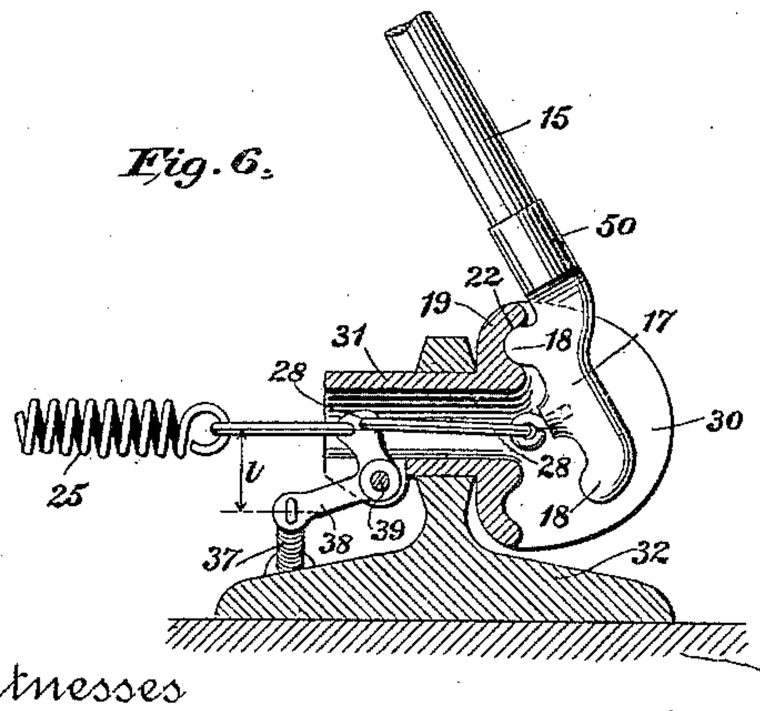
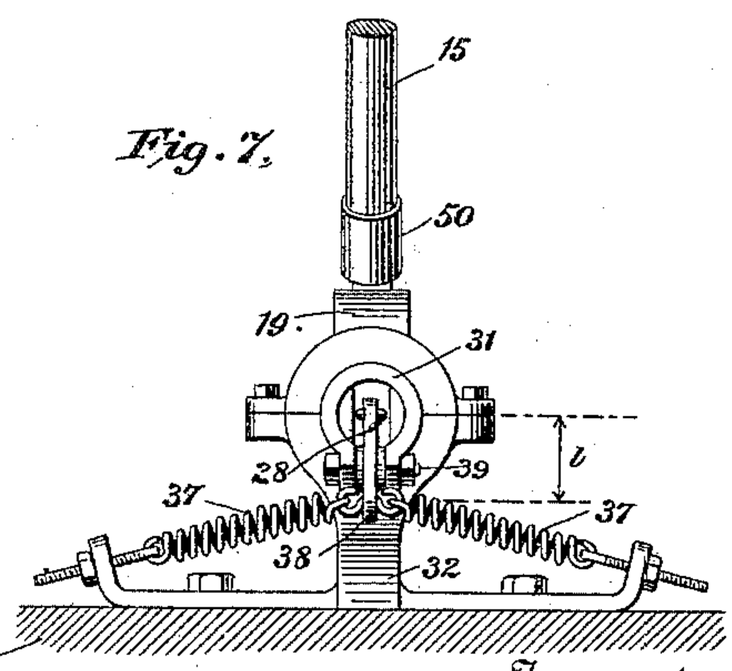


Fig. 7.



Witnesses

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Henry W. Lloyd.

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(No Model.)

2 Sheets—Sheet 2.

M. J. WIGHTMAN.

TROLLEY FOR ELECTRIC RAILWAYS.

No. 448,172. Patented Mar. 10, 1891.

Fig. 8.

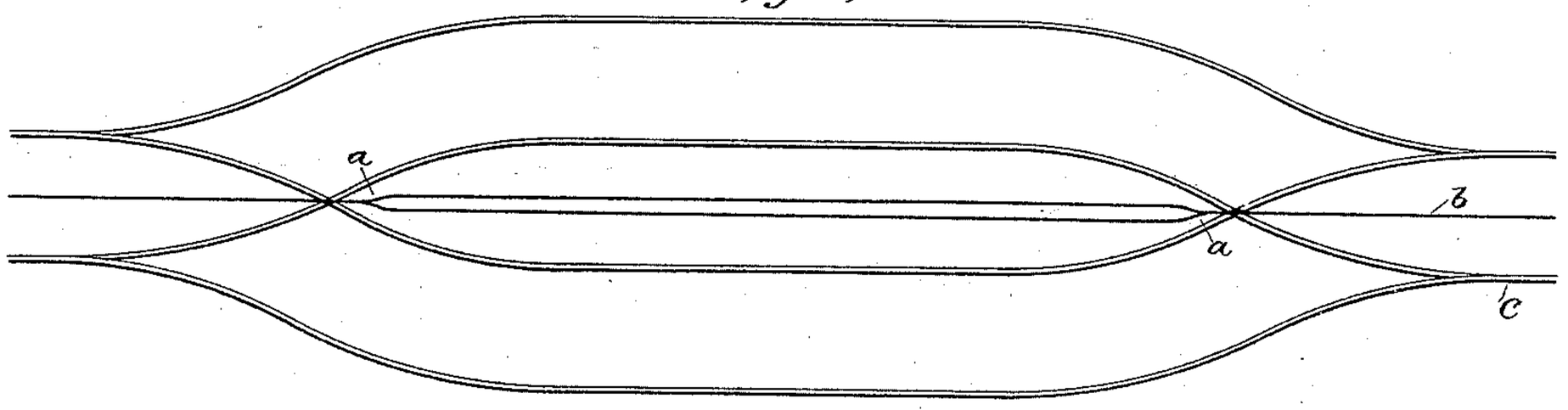


Fig. 9.

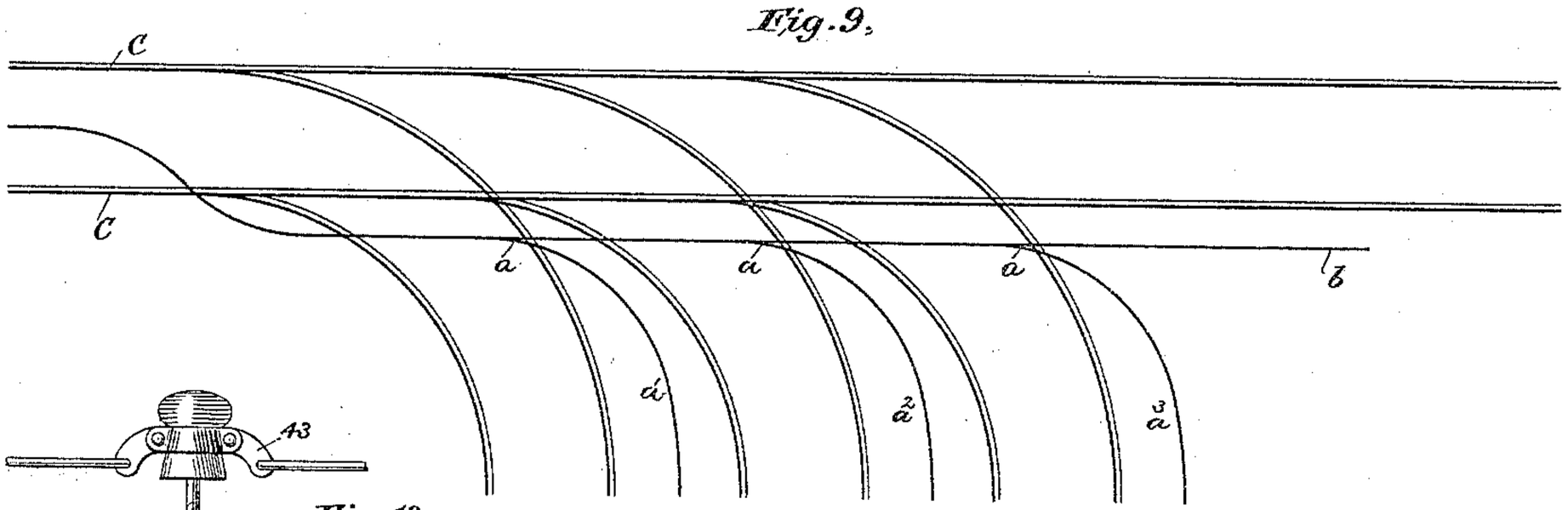


Fig. 13.

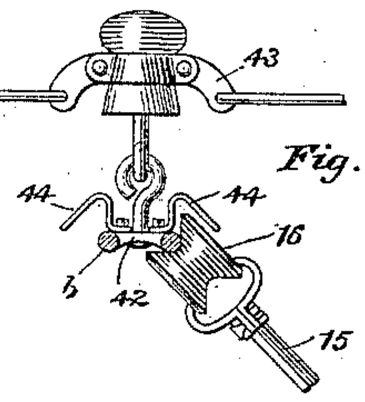


Fig. 10.

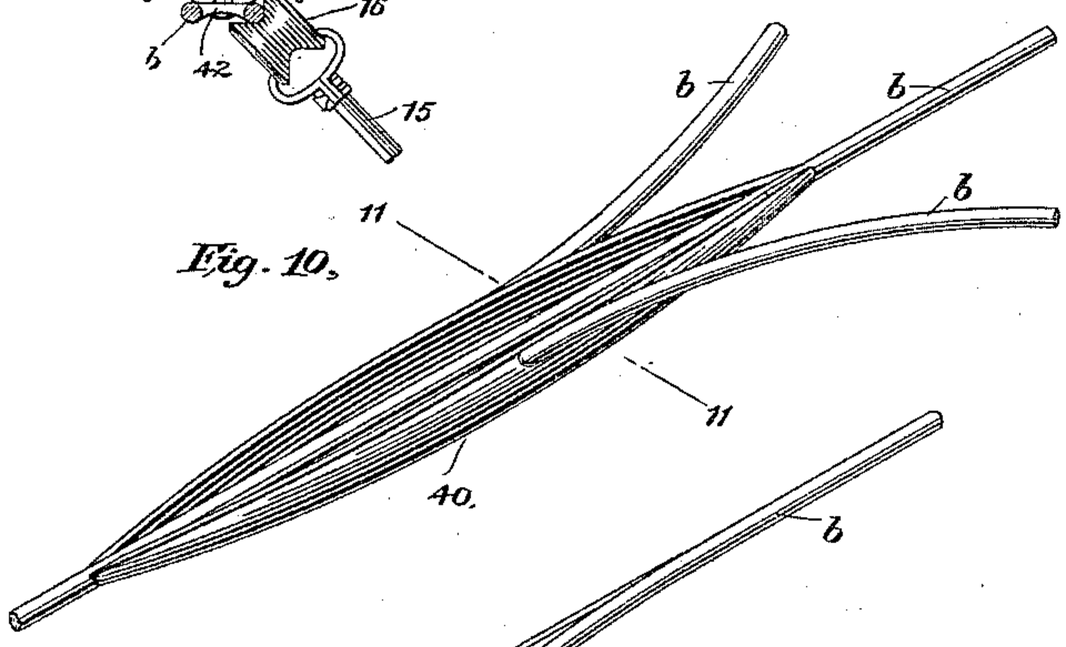


Fig. 11.

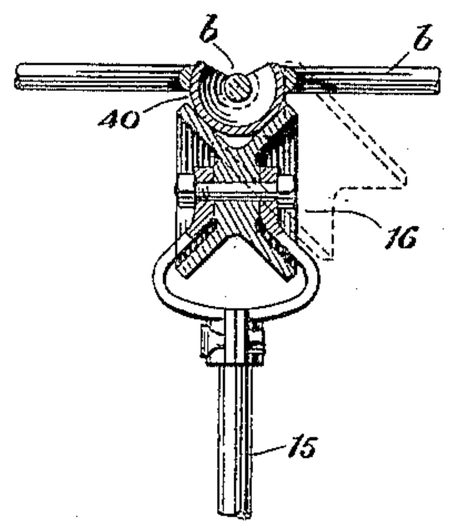


Fig. 12.

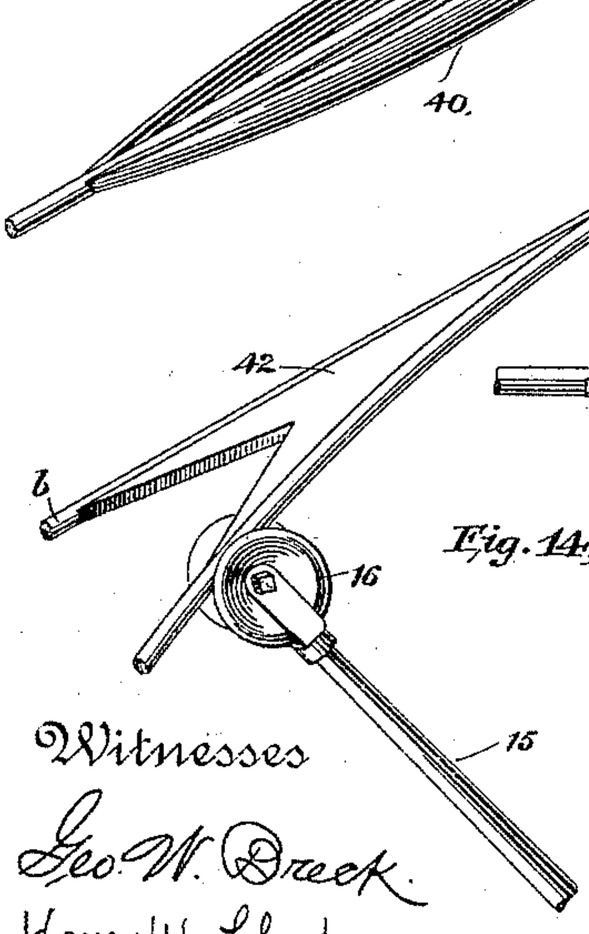
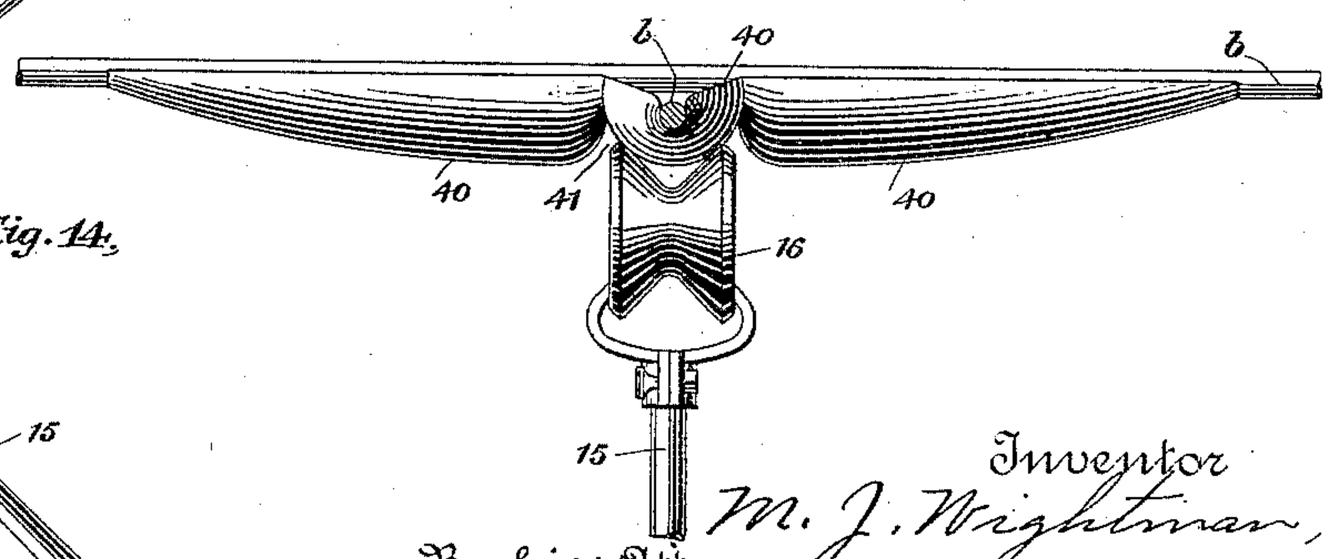


Fig. 14.



Witnesses

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Inventor

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By his Attorneys

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UNITED STATES PATENT OFFICE.

MERLE J. WIGHTMAN, OF SCRANTON, PENNSYLVANIA, ASSIGNOR TO THE WIGHTMAN ELECTRIC MANUFACTURING COMPANY, OF SAME PLACE.

TROLLEY FOR ELECTRIC RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 448,172, dated March 10, 1891.

Application filed August 12, 1890. Serial No. 361,799. (No model.)

To all whom it may concern:

Be it known that I, MERLE J. WIGHTMAN, a citizen of the United States, residing at Scranton, county of Lackawanna, State of Pennsylvania, have invented certain new and useful Improvements in Electric Railways, of which the following is such a full, clear, and exact description as will enable any one skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification.

My invention relates principally to trolley appliances, frogs, turn-outs, junctions, and crossings in systems of electric railways employing suspended overhead electric conductors. The objects sought are to overcome the usual unevenness and the consequent jumping, sparking, and derailment of the trolley or contact device at such points, and to make a cheaper and more sightly overhead structure.

The invention consists in the certain peculiar and novel arrangements and combinations of parts hereinafter fully described, and then pointed out in the claims.

I have illustrated embodiments of my invention in the accompanying drawings, wherein—

Figures 1 and 2 are sectional views of my improved trolley-arm support, the section being taken on a vertical plane longitudinally of the car carrying the trolley, the top of the car being shown in part. Fig. 3 is a top plan view of the construction shown in Fig. 2, with the trolley-arm and its socket-piece omitted. Fig. 4 is a sectional view of one form of my improved trolley-support, the section being taken on the same plane as in Figs. 1 and 2. Fig. 5 is a side view of a form of my improved device. Fig. 6 is a sectional view of a form of the trolley-arm-supporting device, the plane of the section being the same as in Figs. 1, 2, and 4. Fig. 7 is an end view of the device shown in Fig. 6. Fig. 8 is a top plan view of a turn-out, together with the branched trolley-wires employed therewith in my system. Fig. 9 shows the arrangement of the trolley-wires and branches therein at branching-points in the railway-track. Fig. 10 is a perspective view of the branching conductors or trolley-wires used at one end of the turn-out or branch in my system, and Fig. 11 is a transverse sectional view taken on a plane indicated by line 11 11 in Fig. 10, with the addition of a trolley shown both in full and dotted lines. Fig. 12 shows a crossing-point of two trolley-wires provided with my improvements, the view being taken in the direction of the length of one of the wires, which is shown in section. Fig. 13 is a sectional view taken on a vertical plane transverse the trolley-wires at a branching-point, and shows the spacing-block between the conductors, the guard-flanges, and the suspending device, together with a trolley running upon the side of one of the conductors. Fig. 14 is a perspective view of the branching-point in the trolley-wire as used in my system, together with a trolley moving on one branch of the wire.

In the said drawings like letters and numbers of reference indicate like and corresponding parts throughout.

Referring especially to Figs. 1, 2, and 3 of the drawings, 15 designates an ordinary trolley arm or pole, which projects from the top of the car and carries upon its upper end a trolley, such as 16, (shown in Figs. 11, 12, 13, and 14,) the arm in these figures, as well as in Figs. 4 to 7, being shown as broken away. The lower end of the trolley-arm 15 is secured in a socket-piece 50, which is preferably made separate from the trolley-arm, though obviously it may be made part of the same. The lower end of the socket-piece is formed with a disk or rim 17, which has a suitably rounded edge 18, and which constitutes the fulcrum or pivotal point upon which the trolley-arm rocks. The disk or rim 17 engages with and is supported by a base or bearing plate 19, which is fastened horizontally upon a stand 20, which is secured to the top of the car 21. The upper face of the plate 19 is formed with a groove 22, which forms the counterpart of the rounded edge 18 of the disk 17. The outline of the disk 17 being curved the groove 22 is correspondingly curved, so as to afford a track for the edge of the disk to be rolled on, in order to permit the trolley-arm to be gyrated or moved in any direction from the vertical. Any twisting or rotation of the

trolley-arm or socket-piece on its axis is prevented by means of a gear, which in the construction shown consists in teeth 23, formed upon the pivoting portion of the disk 17, and intermeshing teeth 24, formed in the place of the groove or depression 22 in the bearing-plate. The trolley-arm socket-piece is held to the bearing-plate 19 by means of a spring tension device, consisting in a spring 25, the tension of which may be regulated by the adjusting device connected therewith, and which may be connected to the center of the lower part of the socket-piece by any suitable loose connection.

In Fig. 1 the spring 25 is a spiral spring, one end of which is connected to an adjustable point, while the other end is connected to one end of a bell-crank lever 27, the other end of which is connected by a link 28 to the socket-piece.

In the construction shown in Fig. 2, spring 25 is an ordinary laminated leaf-spring, the free end of which is secured to the link 28, which in both Figs. 1 and 2 passes up through a central opening 29 in the bearing-plate 19, and is connected to the center of the socket-piece 50.

The spring 25 tends to constantly seat the socket piece flatly on the bearing-plate 19 and to maintain the trolley-arm 15 in vertical position, so that, in whatever direction the trolley-arm may be displaced from the vertical, the spring-pressure of the tension device upon the trolley-arm will be exerted thereon in such manner that the pressure of the trolley on the trolley-wire will always be in a plane practically parallel to the wire. By virtue of this construction a spring-acted trolley-arm is provided which has a practically universal joint at its point of support, and is capable of pressing in all directions, and which always presses the trolley against the wire in the direction of a plane parallel to the wire. This important principle is also embodied in the forms of the trolley-arm support shown in Figs. 4, 5, 6, and 7, which are hereinafter to be described. As will hereinafter be shown, the employment of this peculiar construction of the trolley-arm support enables me to make contact with the trolley-wire upon either side thereof as easily as upon the bottom, and in this way to dispense with the use of the ordinary switching-frogs at the branching-points.

Provision is made for varying the degree of pressure required in the different planes of movement or swing of the trolley, so that the greatest pressure shall be in the plane practically parallel to the trolley-wire and the least in a plane at right angles to the trolley-wire. In the construction in Figs. 1, 2, and 3 this effect is obtained by making the disk 17 of the socket-piece, likewise the bearing-plate 19 upon which it bears, elliptical, and placing the longest axis thereof parallel to the trolley-wire or longitudinally of the car. This effect of varying the pressure according to the direction in which the trolley is displaced is broadly new, and there are various ways in which it may be obtained, some of which are shown in the constructions now to be described.

In the construction shown in Fig. 4 the bearing plate or support 19 is mounted so as to rotate or swivel about a vertical axis on a bed-plate 32, which is formed with a socket 33, in which turns a shaft or arbor 31 of the support 19. The ball-bearings 34 are provided between the support 19 and plate 32 to lessen the friction, and the support is provided with a laterally-extending bracket 35, upon which is mounted the spring 25, which is connected by a link 28 to the socket-piece 50, at a point intermediate the fulcrum-points 18 thereof. The swiveling support 19 is formed with a vertically-disposed recess 30, in one side of which and in vertical alignment are formed the bearing sockets or grooves 22 for receiving the fulcrum-points 18, which are also arranged one above the other, so that when the trolley-arm stands vertically these two points will rest in the depressions 22, as shown in Fig. 4. The spring 25 being connected through the opening 29 of the support 19 to the socket-piece 50 at a point intermediate the pivotal points 18 thereof, it will be evident that when the trolley-arm 15 is tilted toward the left hand of the figure, the upper point 18 will be brought solely into play, and when tilted in an opposite direction that the lower point 18 will be brought into action, thereby changing the fulcrum from one side of the power-point to the other, as in the previous constructions. The lateral displacement of the trolley is allowed for by the swiveling or turning of the support 19 upon its vertical axis.

In the construction shown in Fig. 5 the socket-piece 50 and the support 19 therefor are constructed practically like that shown in Fig. 4; but they are mounted so as to swivel on a horizontal axis instead of a vertical one by virtue of having the tubular shaft or arbor 31 mounted loosely in a horizontal socket 33, which is formed in a bed piece or stand 32 secured upon the top of the car. The spring 25 is connected to the socket-piece 50 at a point intermediate its fulcrum-points 18 by means of a link 28, which extends through the opening 29 of the tubular shaft 31 of the support. The tension of the spring 25 may be regulated by means of the screw stems and nuts shown attached thereto, and it serves to hold the trolley-arm socket 50 to the support 19, and also serves to hold the support 19 to the stand or bed 32. In the longitudinal displacements of the trolley-arm the socket-piece 50 rocks on its pivotal bearings 18, while the lateral displacement thereof is permitted by the rotation in the horizontal of the support 19, thereby making in effect a universal joint and permitting of the displacement of the trolley in any direction. The tension on the trolley-arm is made to increase the more it is laterally

displaced by means of the cam edge or surface 36, formed at one end of the cylindrical bed 32, and the projections 57, which extend laterally from two opposite points on the shaft or arbor 31, and are provided with anti-friction rollers to facilitate the turning of the support on its axis. In the position shown the trolley-arm and its socket-piece are in a vertical plane, placed longitudinally of the car, and the tension of the spring 25 thereon is at its least. A partial rotation of the support 19 on its axis serves to move the projections 57 onto the high parts of the cam-surface 36, thereby extending the spring and increasing the tension thereof the farther the trolley-arm is laterally displaced. By properly inclining the cam-surface 36 a degree of tension may be obtained sufficiently great to almost resist a side swing or displacement of the trolley.

In the construction shown in Figs. 6 and 7 the trolley-arm socket 50 and its support 19 are made in the same form as that shown in Fig. 5; but the cams and cam-projections are herein omitted. The tubular shaft 31 of the support is mounted loosely in the stand or bed 32, so as to be rotatable horizontally therein, and the rotation thereof is opposed by means of springs 37, which are adjustably secured to fixed points by one end and have their other ends attached to the lower end of the bell-crank lever 38, which is pivoted at 39 to the tubular shaft 31, and has its other end connected by a link 28 to the socket-piece 50 at a point thereon intermediate the bearings or pivotal points 18. These springs serve to oppose the rotation of the support in either direction in the horizontal, while the spring 25, which is connected to the upper end of the bell-crank lever 38, acts through link 28 to force the trolley-arm into vertical position. When the spring is extended and the trolley is moved out of the vertical plane, the tendency to bring the trolley back would be too strong; so the leverage (indicated by *l*) is shortened according to the position of the trolley-arm. This shortening of the leverage, as before described, is a necessary feature in connection with the trolley method herein described. In all the forms of my improved trolley-arm support I provide the same at the point of support with a practically universal joint, and so connect the tension-spring therewith that the pressure on the trolley-pole may always be exerted in the direction of a plane parallel with the trolley-wire, and so as to always maintain the plane of the trolley-wheel parallel to the wire, the only exception to this latter being found in the construction shown in Fig. 4.

In Fig. 8 is shown a method of arranging in this system a double turn-out, wherein both branches come to the same point on the main line. It will be observed that the branch points *a* in the trolley-wire *b* are not located directly above the branching-points in the track C. These points *a a* are preferably located between the branching-points in the track, as indicated in the drawings.

In Fig. 9 is shown a set of branching-points in my system wherein the branching-points *a* and the trolley-wire *b* are located to near one side of the branching-points in the car-tracks C. In this arrangement the trolley-wire is disposed between the rails of the main track, and when it approaches the branching-points therein it is brought over to the outside of the tracks and run preferably parallel thereto across the branches of the track, each of which has a branch a' a^2 a^3 provided for it. The branching-points *a* are located a considerable distance from the branching-points in the track, as is the case in the arrangement at the turn-out shunt in Fig. 8. In both of these arrangements the trolley upon approaching the branch or turn-out will be thrown considerably out of the vertical plane running longitudinally of the car and deflected so as to run upon the side of the wire, and as the trolley is constructed so as to press in all directions it may be readily switched over the branches without the use of the ordinary switches. In case no lead is given the trolley when it is on the main track it will pass clear of the branch wires, as shown in Fig. 11.

In order to facilitate the passage of the trolley over the branching-points, and to insure accuracy in diverting the trolley, I provide the trolley-wire at the branching-point or crossing with an enlargement or body 40, which is rounded upon its sides and bottom and tapered at its ends, as shown in Figs. 10, 11, and 12. This enlargement may be a shell of sheet metal or may be a casting suitably fastened to the wire. Where the enlargement or shell 40 is used at a crossing-point in the trolley-wires, as shown in Fig. 12, the depression 41 is formed in the shells just at the crossing-point, so that the flange of the trolley-wheel may not strike against one shell while passing over the other. In order to make a smooth joint at the junction of the wires, and also to draw the trolley more closely to the wire just as it passes the joint, a V-shaped block 42 is soldered or fastened suitably in the fork of the wires, as shown in Figs. 13 and 14. If the line of contact on the lower flange when the trolley-wheel is tilted laterally is not perfectly horizontal, it will be seen that the tendency of the trolley will be to run closer to the wire, except just at the point where the flange passes the other branch of the wire. The V-shaped frog-block 42 tends to make the junction of the wires firmer, and it may be used as a means for suspending the branch-point by attaching thereto an insulated suspending device 43, as shown in Fig. 13. To prevent any possible derailment of the trolley, an upwardly-bowed guard-flange 44 is arranged above and adjacent to the trolley-wire. Where the trolley-wires are placed close together side by side and the spacing-blocks 42 are used the guard-flanges 44 may be secured to them, so as to cover the wires

like a roof, and at the same time serve as a guard for the trolley. If preferred, these flanges may be cast integral with the block 42 at the branching-points instead of being made separate therefrom. The angle of the groove in the trolley-wheel shown is about forty-five degrees, so that when the trolley is disposed laterally in switching it, the lower flange is displaced horizontally, as indicated in Fig. 13, and also in Fig. 11 in dotted lines. Too wide an angle for the trolley-wheel can be avoided by enlarging one or both of the wires at the junction-point after the manner shown in Figs. 10 and 11. In Fig. 14 the trolley may be supposed to be moving from the branch onto the main trolley-wire.

It is evident that the tension on the trolley could be so adjusted that there would be only longitudinal pressure, and that the trolley would not come into a vertical position, but would topple over on one side as soon as the longitudinal pressure had acted to lift the trolley. It is also clear that the lateral pressure on the trolley can be adjusted so that the tendency to topple over sidewise will be overcome, and the resulting action of the longitudinal and lateral pressure will bring the trolley into a vertical position. If, now, when the trolley is in a vertical position—say the lateral tension is so adjusted that the trolley will stand in any position in which it is placed laterally—it is evident that there is no lateral pressure, and, the longitudinal adjustment being unaltered, the tendency of the trolley to recover itself after a displacement longitudinally can only be in one direction—that is, in a plane practically parallel to the wire.

No claim is here made to a trolley-pole having a universal joint by means of which it may be gyrated about a vertical axis; a gear for the trolley-pole to prevent it from twisting on itself; a rim or disk arranged at right angles to the trolley-pole and provided with a bearing-plate upon which the disk may be rolled; an elliptically-shaped rim or disk for the trolley-pole joint, whereby the degree of pressure may be varied according to the direction in which the trolley-pole is displaced; a toothed bearing disk or rim for the trolley-pole joint meshing with a toothed bearing-plate, (all of which said features are embodied in the construction shown in Figs. 1, 2, and 3;) the suspension of the trolley-wires at a minimum distance apart by means of a single insulated hanger, as shown in Fig. 13, for such features are shown and claimed in another application of mine, Serial No. 361,800, filed August 12, 1890.

Having thus described my improvements in trolley appliances for electric railways, what I claim as my invention, and desire to secure by Letters Patent, is—

1. An electric-railway trolley having a trolley-arm provided with a practically universal joint, and a spring tension device tending to move the arm into vertical position, whereby the direction of pressure between the trolley and the trolley-wire is always in a plane practically parallel to the wire.

2. An electric-railway trolley having a trolley-arm provided with a practically universal joint, and a spring tension device tending to force the trolley-arm into vertical position, the leverage between the trolley-arm and tension device varying with the direction of displacement of the trolley-arm from the vertical, so that the greatest pressure on the trolley-arm is in a plane practically parallel to the trolley-wire and the least in a plane at right angles thereto.

3. An electric-railway trolley having a trolley-arm provided with a practically universal joint, and a tension device or spring tending to force the arm into vertical position, the distance between the pivotal or fulcrum points and the point of application of the power of the tension device or spring varying, so that such distance is greatest in the plane containing the trolley-wire and least in the direction at right angles to such plane.

4. An electric-railway trolley having a trolley-arm mounted upon a suitable support and having a set of pivotal or fulcrum points, so that one or the other of them may be brought into play according to the direction in which the trolley-arm is displaced, and a tension device or spring applied to the trolley-arm between such points, so that in swinging the trolley-arm in one direction or the other the fulcrum may accordingly be changed from one side of the power-point to the other, for the purpose set forth.

5. A trolley-arm support comprising a stand or base and a support mounted thereon so that it may be rotated, and provided with a spring or springs for opposing its rotation and restoring it to normal position, the base of the trolley-arm or its socket-piece provided with a plurality of pivotal or fulcrum points adapted to engage with the said support, a tension device or spring connected with the base of the trolley-arm or its socket-piece at a point between the pivotal points thereof and tending to hold the same to the support.

6. A trolley-arm support comprising a base and a support mounted therein so as to turn on a horizontal axis parallel to the trolley-wire and provided with a set of bearing-points, a trolley-arm socket-piece provided with suitably-spaced fulcrums or pivotal points adapted to engage the bearing-points upon the support, and a spring or springs connected to the socket-piece intermediate its fulcrum or pivotal points and acting to hold the same and the support as well as to oppose the rotation of the support, for the purpose set forth.

7. A trolley-arm support comprising a base and a tubular support having a head formed with a recess communicating with the interior thereof and mounted in the said base so as to rotate therein, bearing-points arranged within the recess at either side of the axis of

rotation of the support, and a trolley-arm socket-piece provided with suitably-spaced fulcrum or pivotal points adapted to engage the bearings on the support, a spring or springs, and connections extending through the interior of the support and attached to the socket-piece at a point intermediate the pivotal points thereof for holding the socket-piece to the support and opposing the rotation thereof, substantially as and for the purpose set forth.

8. A trolley-arm support comprising a base and a support mounted thereon so as to turn, and held thereto by spring power, a cam or cams for moving the support along its axis of rotation when rotated and in opposition to the spring-power, and a spring-acted trolley-arm socket-piece mounted upon the said support so as to rock thereon, for the purpose set forth.

9. A trolley-arm support comprising a tubular base formed with a cam-surface at one end thereof, a support mounted in the base so as to turn therein and provided with projections for engaging the cam-surface of the base, a spring for holding the support to the base and opposing the action of the cam, and a trolley-arm socket-piece mounted on the support so as to rock thereon, substantially as and for the purpose set forth.

10. In an electric railway, the combination, with a trolley-wire having a branch or branches therein located to one side of the center line of the tracks, of a trolley carried by a car having a trolley-arm therefor provided with a practically universal joint and having a spring or springs tending to force the trolley-arm into vertical position, so that the pressure on the trolley is exerted in a plane practically parallel to the trolley-wire, whereby the trolley may be made to take one branch or another, according to which side of the wire it may be running on, without the use of the ordinary frogs, substantially as set forth.

11. In an electric railway, the combination, with a railway-track having a branch therein and a car provided with a trolley having an arm formed with a practically universal joint and provided with springs tending to force the arm into vertical position, so that the pressure on the trolley may always be in a plane practically parallel to the trolley-wire, of a trolley-wire suspended above the tracks and formed with a branch therein disposed to one side of the track, whereby the trolley may be diverted from the main wire to a branch, or vice versa, without the use of the ordinary frogs, substantially as set forth.

12. In an electric railway, the combination, with a railway-track formed with a turn-out and a car provided with a trolley having a spring-acted trolley-arm formed with a practically universal joint at its point of support and exerting its pressure on the trolley-wire in a plane practically parallel with the trolley-wire, of a trolley-wire suspended above the tracks and formed with branches therein corresponding to the branches in the turn-out in the track, the said branch wires being disposed between the branches of the turn-out, whereby the trolley may be diverted from the main wire to one or the other of the branches, or vice versa, according as the trolley is made to run on one side or the other of the wire, substantially as set forth.

13. In an electric-railway system, the combination, with a trolley, of a trolley-wire having a branch therein and a V-shaped block seated in the fork of the branch and suitably secured therein, whereby the wires may be more evenly joined, substantially as set forth.

14. In an electric-railway system, the combination, with a trolley, of suspended crossed or branched conductors formed with a laterally extended or broadened body at the crossing or branching points for assisting the crossing or switching of the trolley, substantially as set forth.

15. In an electric-railway system, the combination, with a trolley, of suspended crossed or branched conductors provided at the crossing or branching points with a rounded body tapered at its ends for assisting the passage of the trolley over such points, substantially as set forth.

16. In an electric railway, the combination, with a trolley, of crossed conductors, each provided at the crossing-point with a rounded and tapered enlargement or body having a depression at the crossing-point for facilitating the passage of the trolley across such point, substantially as set forth.

17. In an electric railway, the combination, with branching conductors, of a block secured in the fork of the branch and an insulated suspending device attached thereto for supporting the conductors at the branching-point, substantially as set forth.

18. In an electric railway, the combination, with a suspended conductor and a trolley, of an upwardly-bowed guard-flange fastened above the conductor adjacent thereto, so as to cover the same as a roof and prevent the derailment of the trolley.

19. In an electric railway, the combination, with a trolley and two conductors arranged near each other and blocks or spacing pieces secured between the conductors, of an upwardly-bowed guard-flange for each conductor, secured above the same and projecting in opposite directions and each one covering a conductor and serving as a guard for the trolley running thereon.

20. In an electric railway, the combination, with a trolley and two conductors arranged near each other, with spacing blocks or pieces secured between the conductors, of an upwardly-bowed guard-flange for each conductor, secured by one edge to the said spacing blocks or pieces, and each serving to cover one of the conductors and acting as a guard for the trolley, substantially as and for the purpose set forth.

21. In an electric railway, the combination,

with a trolley and two conductors arranged near each other, with spacing blocks or pieces fastened between the conductors, of insulated suspending devices secured to the spacing blocks or pieces for supporting the conductors, substantially as set forth.

22. In an electric railway, the combination, with branching conductors, of a V-shaped block secured in the fork of the branch between the conductors, and provided with upwardly-bowed guard-flanges projecting above the conductors and in opposite directions from each other, and acting as a guard for the trolley in passing over the branching-point, substantially as set forth.

23. In an electric railway, the combination, with a railway-track having a branch, and a trolley-wire suspended above the same and formed with a branching-point corresponding to the branch in the track, but located to one side thereof, of a car provided with a trolley having an arm capable of pressing in all directions, whereby the trolley may be tilted so as to run upon the side of the wire in passing the branching-point, substantially as and for the purpose set forth.

24. In an electric railway, the combination, with a car having a trolley provided with an arm capable of being longitudinally and laterally displaced from the vertical, of a railway-track C, provided with a branch or branches, and a suspended trolley-wire *b*, formed with the branching-points *a a*, corresponding each to a branching-point in the track and located to one side thereof, substantially as and for the purpose set forth.

25. The combination, with a trolley-arm 15, having its lower end provided with the fulcrum or pivotal points 18, and a bearing-plate 19, of a spring tension device attached to the base of the trolley-arm at a point intermediate the fulcrum or pivotal points 18 and adapted to hold the same to the bearing-plate 19, whereby the fulcrum may be changed from one side of the power point to the other, substantially as and for the purpose set forth.

26. The combination, with a trolley-arm 15, having its base provided with the fulcrum or pivotal points 18, and a bearing-plate 19 for the same to pivot on, of a spring 25, connected to the base of the trolley-arm at a point between the fulcrum-points 18, substantially as and for the purpose set forth.

27. The combination, with a trolley-arm 15, having the base thereof provided with the fulcrum or pivotal points 18, of a rotatable support 19 and a spring or springs for holding the trolley-arm to the support and opposing the rotation of the support, substantially as and for the purpose set forth.

28. The combination, with a trolley-arm 15, provided with a socket-piece 50, formed with an extension 17, which is provided with the pivotal or fulcrum points 18, of a support 19, provided with a tubular shaft 31, and a stand in which said shaft is loosely mounted so as to turn therein, a spring or springs connected to the socket-piece 50 at a point intermediate its pivotal points 18 and tending to hold the socket-piece to the support and to oppose the rotation of the support, substantially as and for the purpose set forth.

In testimony whereof I have hereunto set my hand, this 5th day of August, 1890, in the presence of two subscribing witnesses.

MERLE J. WIGHTMAN.

Witnesses:
PIERCE BUTLER,
HORACE E. HAND.