

(No Model.)

6 Sheets—Sheet 1.

F. MANSFIELD.
ELECTRIC RAILWAY.

No. 579,759.

Patented Mar. 30, 1897.

Fig. 1,

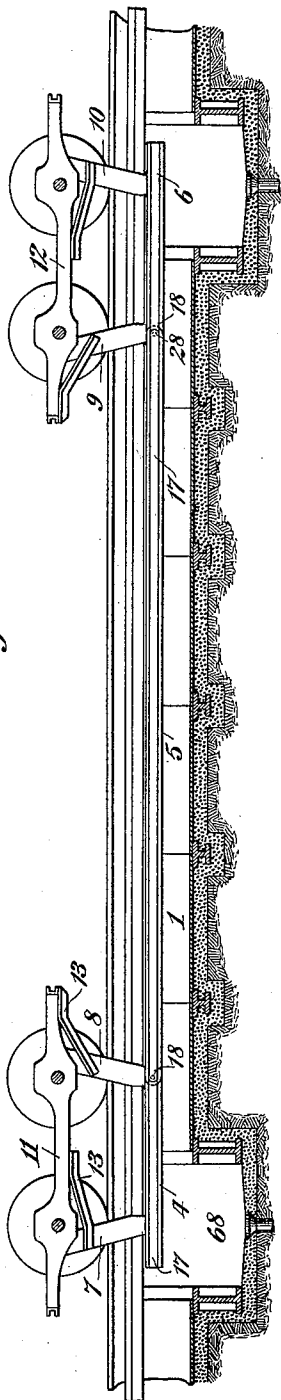
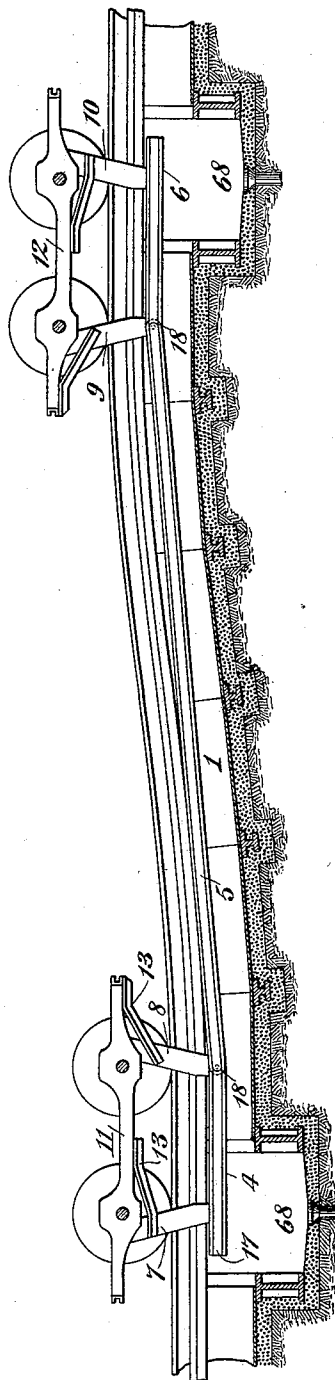


Fig. 2,



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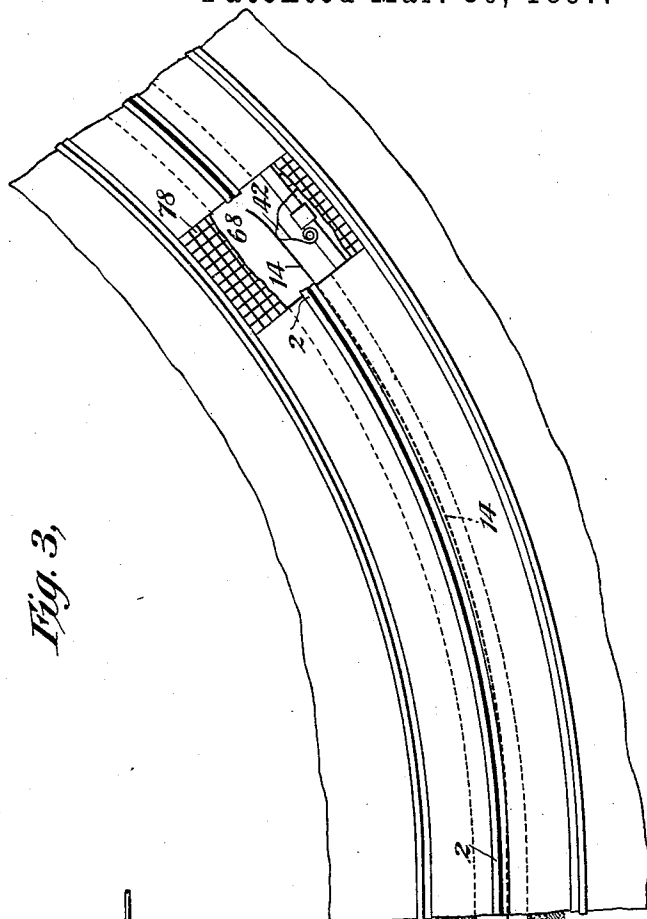


Fig. 3,

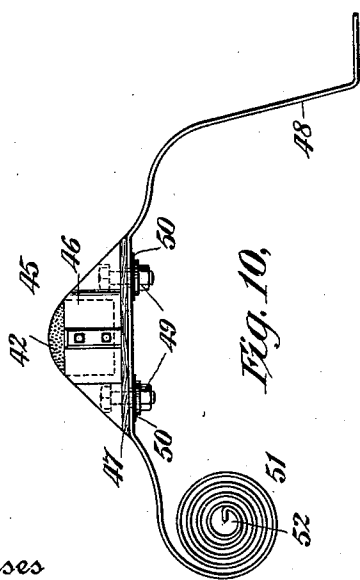


Fig. 10,

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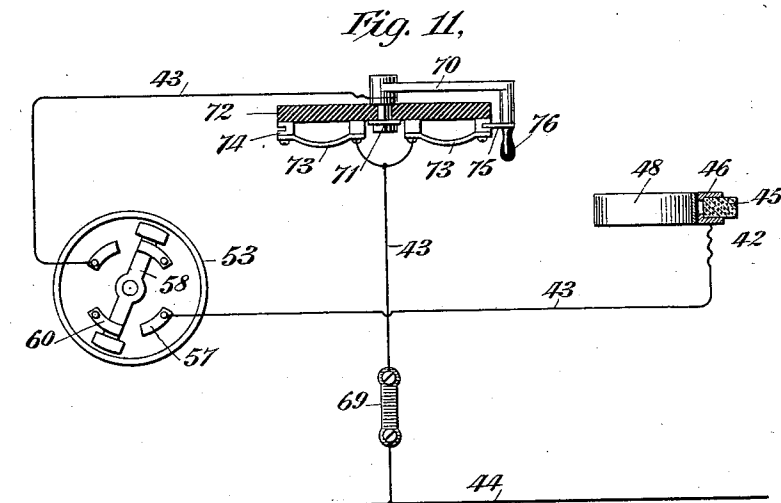
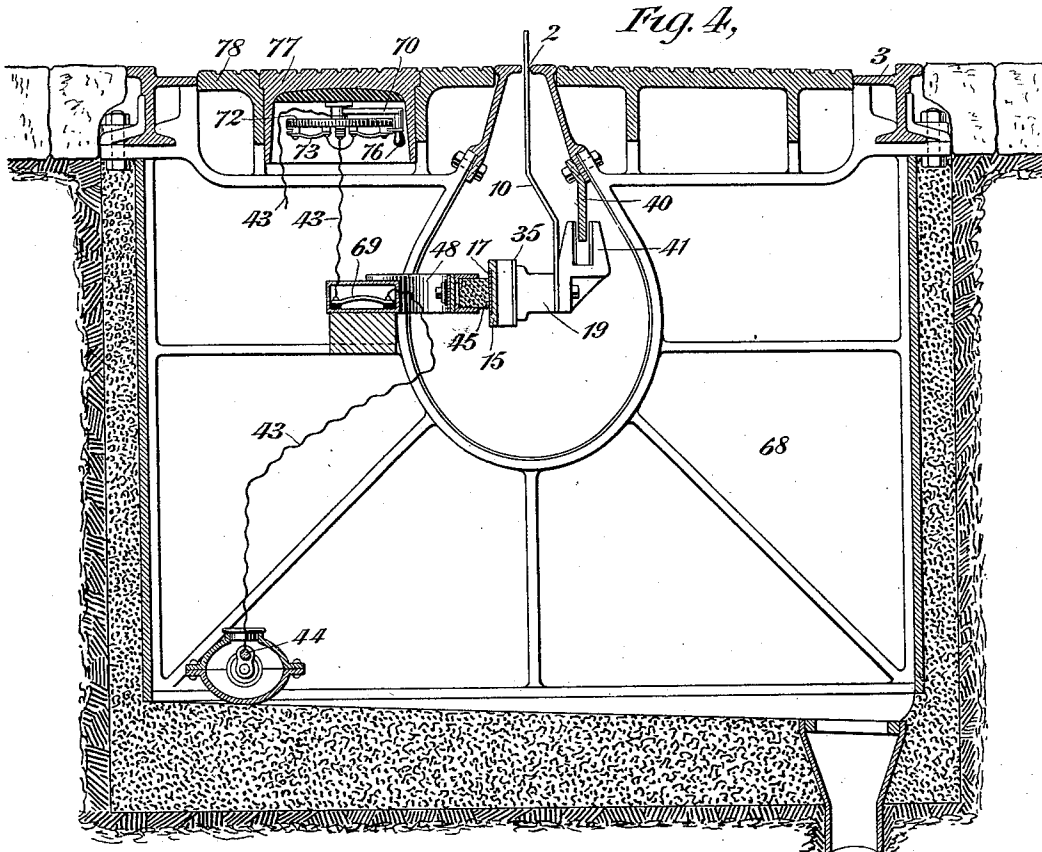
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Fig. 5.

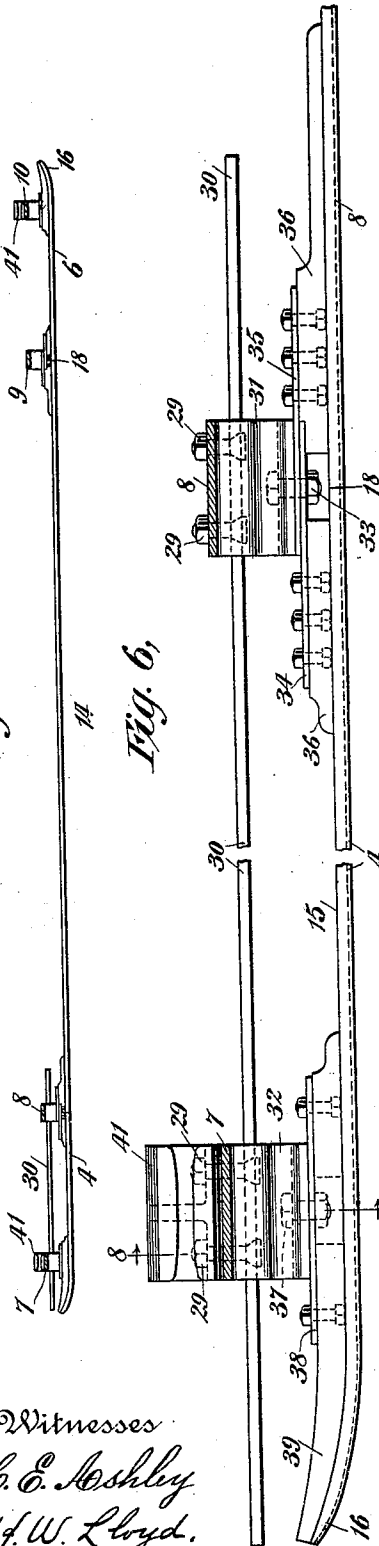


Fig. 6.

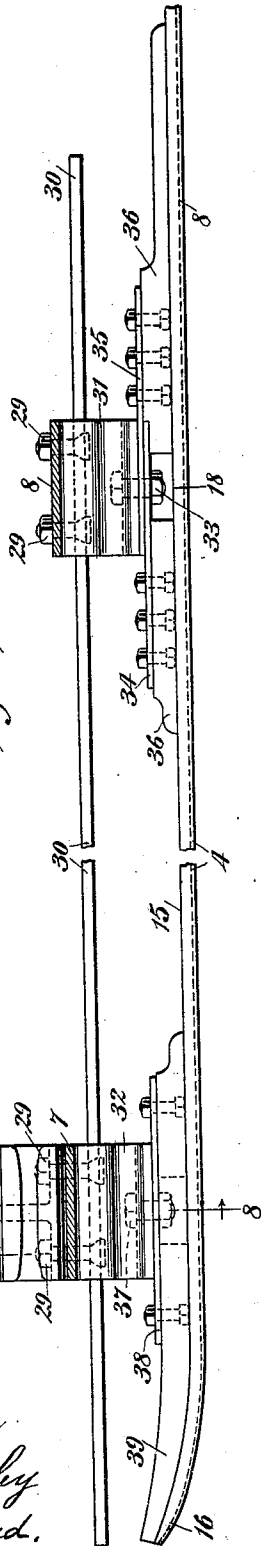


Fig. 7.

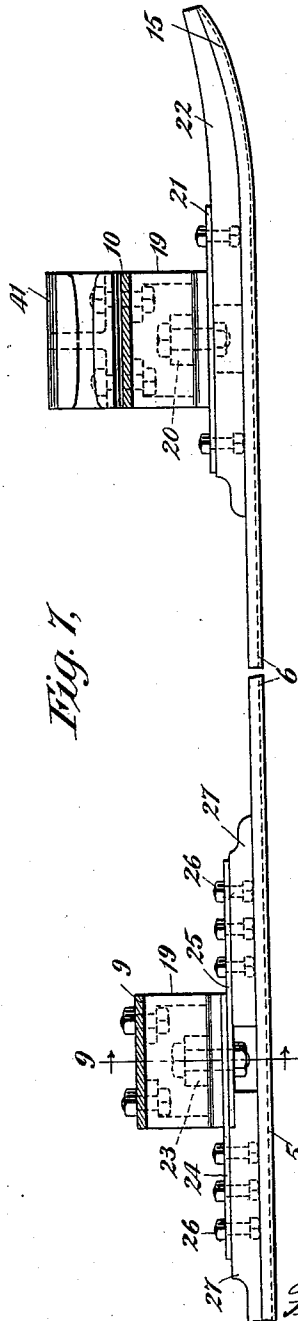


Fig. 8.



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Fig. 12,

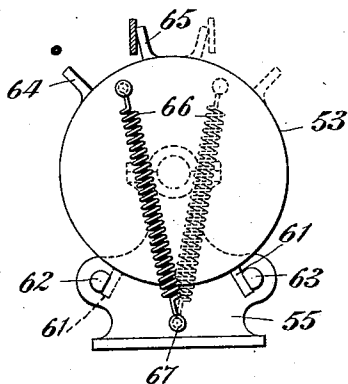


Fig. 13,

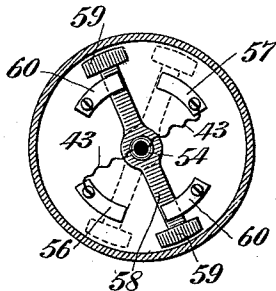
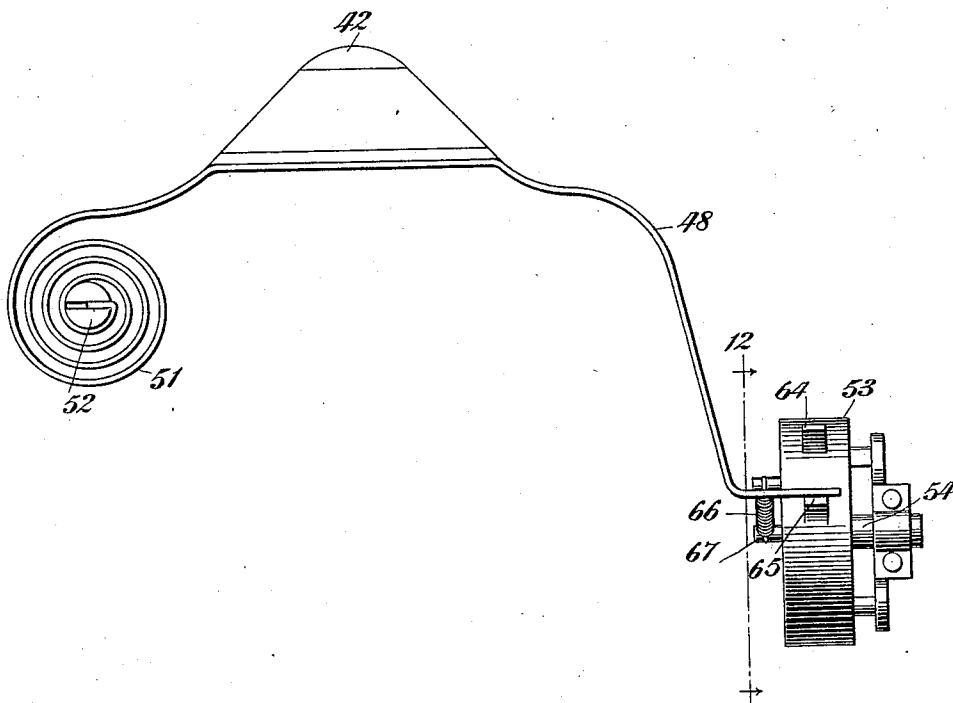


Fig. 14,



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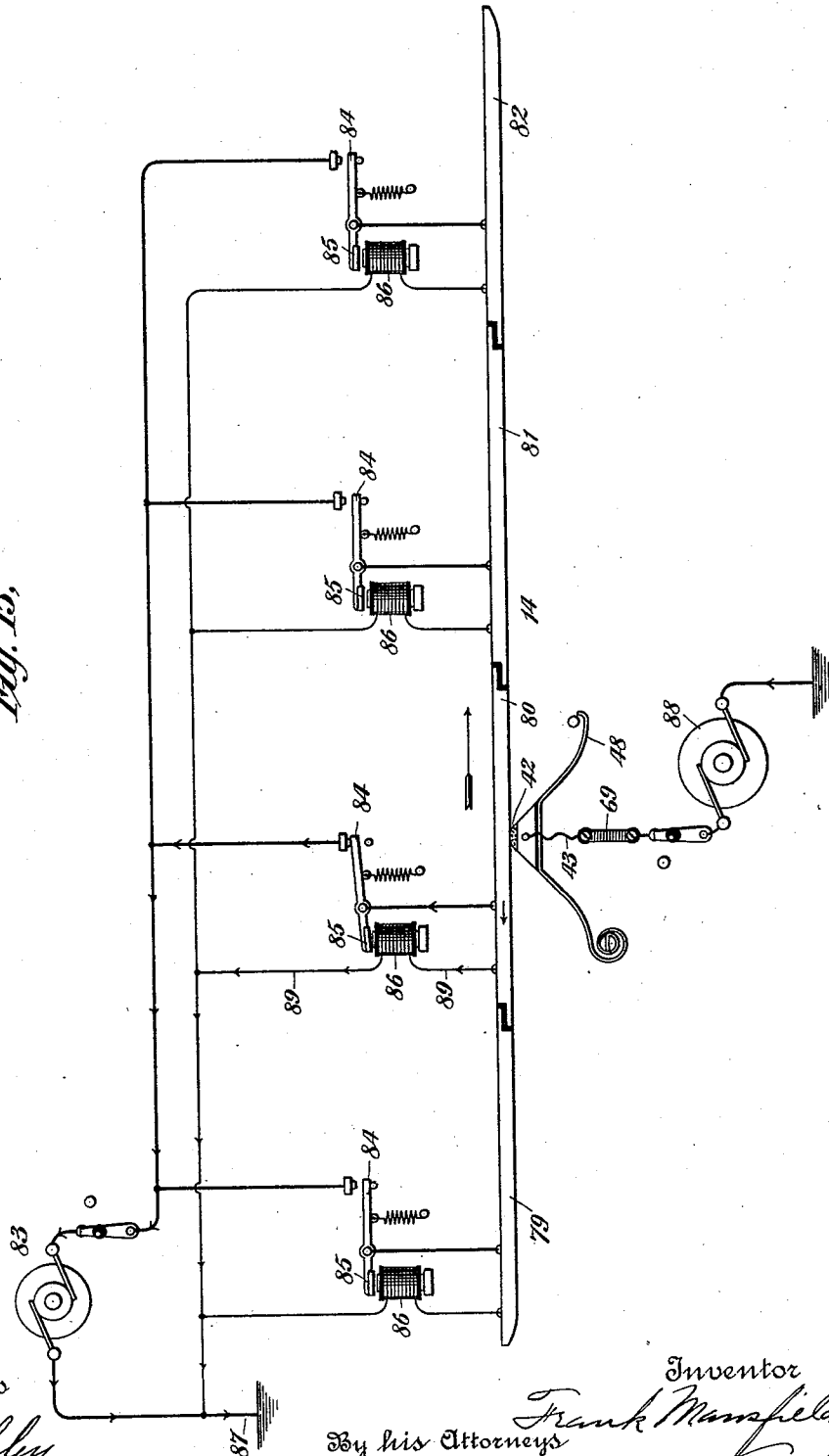
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Fig. 15,



Witnesses

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UNITED STATES PATENT OFFICE.

FRANK MANSFIELD, OF NEW YORK, N. Y.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 579,759, dated March 30, 1897.

Application filed August 4, 1893. Serial No. 482,348. (No model.)

To all whom it may concern:

Be it known that I, FRANK MANSFIELD, a citizen of the United States, residing at New York, county and State of New York, 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.

In the accompanying drawings, illustrating my invention, Figure 1 represents in longitudinal vertical section an open or slotted conduit with my improved contact device arranged therein and shown as suspended from ordinary car-trucks, the car itself being omitted for convenience of illustration. Fig. 2 is a similar view to that shown in Fig. 1, with the exception that it represents a portion of the railway at a slight incline in contradistinction to the level portion shown in Fig. 1. Fig. 3 is a plan view, partly in horizontal section, of my improved conduit, together with a contact device and spring-contact carrier operating the switch of the branch conductors. Fig. 4 is an enlarged view of a vertical transverse section of the conduit and road-bed, the section being taken through a man-hole. Fig. 5 is a plan view of my improved contact device attached to the car. Figs. 6, 7, 8, and 9 represent enlarged views of details of the contact device, as will be hereinafter described, the view shown in Fig. 8 being a section taken on a plane indicated by line 8 8, Fig. 6, and the view shown in Fig. 9 being also a section taken on a plane indicated by line 9 9, Fig. 7. Fig. 10 is an enlarged plan view of one of the spring-carriers for a contact-point of a branch conductor. Fig. 11 is a diagrammatic view showing the relative disposition in circuit of a contact-point of a branch conductor, the switch of such branch conductor, together with a fuse-magazine. Fig. 12 is an enlarged exterior view of a snap-switch located in the branch conductor, together with a part of the spring-carrier which operates the switch, said carrier being shown in section on a plane indicated by line 12 12, Fig. 14. Fig. 13 is an interior view of the snap-switch with the frame or casing thereof

in section. Fig. 14 is a plan view of a spring-contact and the snap-switch operated thereby. Fig. 15 shows diagrammatically a sectional contact-bar, together with the automatic circuit-completers for the sections, a spring-carrier for a branch conductor, and a motor-circuit.

Referring to the drawings, in which like numbers of reference designate corresponding parts throughout, 1 represents an open conduit provided with a slot 2, extending along the road-bed 3. Traveling in this conduit is my improved contact device consisting of a bar composed of sections 4, 5, and 6, which are formed vertically inflexible but flexible or yielding laterally in the horizontal plane. These sections are hinged together end to end, as will be explained hereinafter, so as to constitute in effect a single horizontal bar. This sectional bar is suspended within the conduit by means of suitable supports or hangers 7, 8, 9, and 10, which depend, preferably, from the trucks 11 12 of the car and extend through the slot of the conduit.

It will be noted that each point of connection between a support or hanger and the contact-bar is made directly beneath an axle of the truck. This peculiar arrangement, in conjunction with the hinged joints in the bar, will permit the bar to compensate for variations in the grade of the road-bed, as will be readily understood from Fig. 2, wherein the truck at the right-hand end of the view, which may represent the opposite end of the car from that represented by the truck at the left-hand end, is elevated considerably above the other truck. Under this condition, and in which the points of support are thrown out of the horizontal plane, the sections or links composing the bar are moved vertically relative to each other on their hinge-joints. Thus in Fig. 2, the section 6 having become elevated considerably above the plane of section 4, the intermediate part or section 5 will assume an inclined position by reason of the hinge-joints, while the end sections remain in horizontal position, since the latter are supported in such manner that each one remains constantly parallel with the plane containing the axis of the truck-axles, beneath which it is supported. In the construction shown the supports or hangers 7, 8, 9, and 10 are shown

as extending rigidly from the frame of the truck, and each one is provided with a brace-bar 13, which serves to strengthen the supports in the direction of the length of the contact-bar. Of course the supports may be suitably mounted upon the axles themselves, provided they are held from swinging, as it is immaterial from what part of the truck the supports may be hung, so long as there is a fixed relation between the axes of the axles and the points of attachment between the supports and the contact-bar.

Each section or link of the contact-bar is constructed so as to be practically non-flexible in a vertical direction and yielding or flexible laterally, so that the entire bar may be bent or deflected laterally as the car passes over a curve in the track, such bending of the bar being represented in Fig. 3, wherein a portion of a curve, together with a straight part of the track and conduit, are shown in plan, the contact-bar being here represented diagrammatically by a single line 14. If a curve in the road should be on an incline, the lateral flexibility of the contact-bar will permit the bar to bend sufficiently to pass around the curve, while the hinge-joints of the sections of the bar will compensate for the relative vertical movement of the trucks. These sections of the contact-bar (see more especially Figs. 5 to 9) are formed with a flat back or main part 15, which is made of a suitable insulating material, such as wood, and is laterally flexible. The forward and rear ends of the bar are curved or rounded, as shown at 16, in order that the bar may pass readily on to the contact-point, hereinafter described.

A flat metallic strip 17 is mounted or inlaid upon the outer flat face of the insulating part 15, and this strip is continuous from end to end of each section and constitutes the conducting strip or surface which makes contact with the series of contact-points in the conduit and which, on the other hand, is in electrical connection with the motor on the car or vehicle. Any of the well-known and suitable means may be used for connecting this metallic strip with the motor when the contact-bar comprises but a single electrical section—that is, when it is not electrically a sectional contact the metallic strips 17 are made electrically continuous from end to end of the bar by virtue of the close hinge-joints 18 18, (see Figs. 1, 2, and 9,) which are on the order of a rule-joint. The back or main part 15 of this bar serves to completely insulate the metallic conducting-strip 17 from any part of the mounting of the bar, which is sustained or mounted as follows: The lower end of the support 10 is rigidly bolted to piece 19, which by means of a bolt 20 (see Fig. 7) is made fast to a plate 21, which is itself secured to a block 22, made of wood, for example, and attached to the inner side of the back or main part 15. This forms a fixed point of attachment for this end of the contact-bar, and it will serve to take up a great part of the end-on strain

which may be exerted on the contact-bar as it collides with the contact-points in completing the circuit.

The next support 9 is likewise rigidly secured to a piece 19, which is provided with a pivot or hinge bolt 23, which passes loosely through the overlapping hinge-plates 24 25, the outer ends of which are fastened rigidly by bolts 26 to the blocks 27, which are made fast, respectively, to the abutting ends of the sections 6 and 4 of the bar. This pivot-bolt 23 is placed in axial alinement with the hinge-pin 28 of the hinge-joint 18, formed in the metallic conducting-strip 17. (See Figs. 5, 7, 9, and also Figs. 1 and 2.) By this construction the contact-bar is sustained by support 9 rigidly in the direction of length of the bar. At the same time the abutting sections 6 and 5 thereof may move on the hinge-joint between them.

The support 8, as well as the support 7, is attached rigidly by means of bolts 29 29 to a sustaining-bar 30, which is held parallel with the adjacent section 4 when the contact-bar is not deflected. This sustaining-bar 30 is provided with two slides 31 32, the former of which is provided with a pivot-bolt 33, which extends loosely through the overlapping plates 34 35, bolted securely to blocks 36, which are attached to the inner face of main part 15, one near each end of the abutting sections 5 and 4. In this way the contact-bar when flexed laterally may slide relatively to the sustaining-bar 30 at the point of support afforded by the member 8. The slide 32 (see Figs. 6 and 8) is rigidly bolted, by means of a bolt 37, to the plate 38, which is made fast to the block 39, attached to the back or main part 15. This construction also permits of the bar sliding or moving relatively to the part 30 at the point where the support 7 is attached to the bar. By virtue of this construction it will be seen that there are four points of support, one corresponding to each axle of the trucks, and that one of such supports 10 is fastened rigidly to the contact-bar, so as to take up a great part of the end-on strain. Another support 9 is rigidly fastened in the horizontal to a hinge moving in the direction of stiffness of contact-bar. Another support 8 is so connected with the contact-bar as to permit it to slide, and at the same time be moved vertically on the hinge-joint at that point, while the support 7 sustains the contact-bar by a sliding connection. It will thus be seen that the contact-bar is adapted to readily compensate for any vertical displacement of the trucks in passing from a level to an incline, or vice versa, by virtue of the hinge-joints, which move on horizontal axes, and at the same time the bar can be flexed laterally in passing around a curve.

At a suitable part of the interior of the conduit is arranged a projection or rail 40, Fig. 4, which extends the length of the conduit and is designed to be loosely engaged by a forked member or shoe 41, secured upon the contact

device. This serves to guide the contact-bar and maintain it in a true line of movement. By preference I use two of the guide-shoes 41, one at each end of the contact-bar. One of these shoes is conveniently secured to the lower end of the support 10 by means of the same bolts which secure the piece 19 to such support, as is shown in Fig. 7. The other shoe 41 is made fast to the lower end of the support 7 by means of the bolts 29, which extend through the support and serve to hold thereto the sustaining-bar 30. (See Figs. 6 and 8.)

At equal intervals along the conduit are arranged contact-points 42 of the series of branch conductors 43, which lead from the insulated subterranean main conductor 44, and which are normally disconnected by means of a switch, hereinafter described, which is automatically thrown into action and closed as the contact-strip collides with the contact-point 42. Each of the contact-points 42 comprises a carbon block 45, which is set in a metallic holder or frame 46, which is suitably insulated by a wooden plate 47 from the spring carrier or support 48, to which the contact-point or its holder is securely fastened by means of bolts 49, the latter also being insulated from the carrier by plates 50 50. (See Fig. 10, and also Figs. 4 and 11.) The spring-carrier 48 consists in a flat metallic spring, one end of which is coiled at 51, where its end is secured to a suitable fixed point 52, the other end of the carrier extending free and arranged so as to close and open the switch in the branch conductor when the contact-bar carried by the car slides over the contact-point 42, and then passes off the same. Normally the spring-carrier is not tense, and it is so placed in horizontal position that the contact-point carried thereby projects across the path of the traveling contact-bar. When the latter collides with the contact-point, the spring-carrier is pressed to one side and the spring is put under tension while the contact-bar slides over it. This insures intimate contact between the conducting-strip on the contact-bar of the car and the contact-point 42 of the branch conductor. When the contact-bar is moved past the point 42, the spring-carrier moves back to normal position by virtue of its resiliency, and the sweep or range of movement of this carrier is utilized to automatically connect and disconnect the local branch conductor from the main conductor. There are numerous forms of well-known switches, which preferably should be water-tight, that may be used for this purpose in conjunction with my novel form of spring-contact carrier.

For the purpose of making and breaking the circuit over the branch conductors I have devised a special form of switch, which, by reason of utilizing the momentum of a swinging or oscillating member to close and open the circuit, may be used with advantage where the switch is to be placed underground.

I have illustrated this switch in but one form, and in this 53 is a frame made, preferably, in the form of a hollow cylinder closed at both ends, so as to be water-tight. This frame or box 53 is mounted so as to oscillate or rock on an arbor 54, which is mounted in any suitable manner, though I have shown it as arranged upon a stand 55. The branch conductor 43 is led into the interior of the switch box or drum and also out from it, preferably through the arbor 54, which may be made hollow for that purpose and is to be water-tight. Within the switch-box 53 are arranged at suitable points two terminal plates 56 and 57, which are ordinary spring tongues or fingers like those used in electric switches generally. The switch or contact lever 58 for bridging the terminals, so as to place them in electrical connection, is swung within the box 53 in such a manner that when the switch box or frame, which has a prescribed range of movement on its axis, is given a forcible throw or turn said lever will be swung on its center of movement and its momentum will carry it into forcible contact with the terminals 56 57, as shown in broken lines in Fig. 13. I preferably pivot the lever 58 about midway of its ends and mount it upon the inner end of the arbor 54. This gives the lever a balanced action, and in order to increase its momentum I place weights 59 at each end of it. I further provide means for holding the contact-lever 58 in open position, as shown in Fig. 13. It is requisite for such holding means to hold this lever against the action of gravity, but not with sufficient force to resist the force exerted upon it when the rocking switch frame or box has been thrown on its axis and then brought abruptly to rest. As one means of so holding this lever I provide spring-strips 60 60 at suitable points within the switch-box, each one being adapted to engage one end of the lever with a slight spring-pressure when the lever is forced under it by its momentum, when the switch-box is thrown on its axis to open the switch. In this latter action the switch-lever passes from the dotted-line position to the full-line position, as shown in Fig. 13, thereby opening the switch and clutching or securing the contact-lever in open position and in which it remains until the switch-box is given a forcible throw to dislodge it. Instead of the spring-strips 60 being used other forms of friction devices may be employed for the same purpose.

The box or frame carrying the switch mechanism is limited in its rocking movement on its bearing by means of a projection 61, which extends from the same and plays between two stops 62 63, which are placed a suitable distance apart. When the switch is open, as shown in Fig. 13, the projection or lug 61 rests against stop 63. Now when the switch-frame is suddenly thrown or jerked, so as to give it a partial turn, the frame or box will swing on its center of movement until the

projection 61 strikes against the stop 62. As the switch-frame thus swings it may or may not dislodge the contact-lever from its holding device, but upon the termination of this movement by means of the stop 62 the switch-lever will be forcibly released from the holding device and will move with sufficient momentum to insure its making contact with the terminals and thereby closing the circuit.

This switch is automatically operated by the spring-carrier 48, the end of which takes in between two pins or lugs 64 65, which are preferably arranged upon the periphery of a cylindrical switch-box. When the switch is open, these parts stand in the relation shown in Figs. 12 and 13. As the contact-bar forces the carrier to one side the free end of the latter bearing against the pin 65 throws the switch box or frame over its prescribed range of movement, and when this is accomplished the free end of the carrier assumes the relation shown in dotted lines in Fig. 12, under which condition the switch is closed and the circuit thereby completed over the branch conductor. As the contact-bar passes off of the contact-point presented thereto by the carrier the latter resumes normal position and in so doing forcibly moves the switch box or frame in a reverse manner from that just described. This opens the switch and the parts assume the position shown in full lines in Figs. 12 and 14. In order to insure the operation of the switch, I provide the same with a spring 66, which is secured by one end to a point on the frame or switch-box to one side of, that is, out of alinement with, the center of motion of the frame or box, while the other end of the spring is secured to a suitable fixed point 67. By virtue of this construction when the switch frame or box has moved about half-way over its prescribed range of movement the tension of this spring will then come into play in assisting the movement of the box and will serve to give it a jerk that will increase the momentum of the switch-lever. In Fig. 12 the extreme limits of movement of this spring are shown in full lines on the one hand and dotted lines on the other. When the switch-box is thrown backward to open the switch, this snap-spring again comes into play and in a reverse manner serves to jerk the switch, and hence the contact-lever, back to normal position, the spring being effective in an obvious manner as it crosses the center of motion of the switch-box. As the contact-carrier 42 is arranged in horizontal position the switch-box is accordingly placed vertically with its center of movement on a horizontal axis.

The contact-points 42, and hence the branch conductors, are arranged along the length of the conduit at intervals equal to a little less than the length of the contact-bar carried by the car in order that there may be at all times one such contact-point in contact with said bar, so as to keep the motor continuously supplied with current. An ordinary man-

hole 68 is arranged at each place, where a contact-point 42 and its accompanying apparatus may be located. The branch conductor 43, which is thoroughly insulated throughout, is freely accessible within the manhole, and it extends from the contact-point 42 over the switch which has just been described, thence through a magazine of fuses, thence by way of an auxiliary fuse of large capacity, and which is indicated at 69, (see Figs. 4 and 11,) to the main conductor. This magazine of fuses forms part of my invention and is constructed as follows: A metallic lever 70 is suitably pivoted by one end at 71, so as to swing around a circular plate or bed-piece 72, which is preferably made of insulating material in order to insulate all the parts mounted thereon. Upon the plate 72 are mounted in radial positions a series of fuses 73, which are each connected, preferably by the innermost end, to the branch conductor 43, as shown in Figs. 4 and 11. The outer end of these fuses are each provided with a contact device or jaw 74, which is engaged by a suitable projection 75, located upon the lever 70, and which is in electrical connection with the branch conductor 43 through means of said lever. This lever is provided with an insulated handle 76 for swinging the lever on its bearing when bringing into the circuit a new fuse, which is done by moving the lever so as to disconnect the extension 75 from the part 74 of one fuse—for instance, a burned-out one—and connecting it with the similar part 74 of a new fuse, all of the contacts 74 being located along the circular path described by the contact 75 of the lever. This fuse-magazine is placed within a hood 77, which is shaped like an inverted cup or bell and is inserted within the cover 78 of the manhole, so as to be easily removable therefrom in order to gain access to the magazine in a ready manner when it is desired to inspect the same or replace the fuses. The purpose of having this hood shaped like an inverted cup is to prevent any water which might fill the manhole from rising in the hood to the fuse-magazine. Should the manhole become flooded with water, it would rise a slight distance in the hood to a point where the air therein would become sufficiently compressed to prevent the further rise. The fuse-magazine being located above this water-line it will be out of reach of any such accidental presence of water.

In Fig. 15 I show diagrammatically a contact-bar formed in four electrical sections 79, 80, 81, and 82, each one of which is in circuit with the motor shown at 83, such circuit being controlled by a switch-arm 84, which is normally open and is formed by an extension of the armature 85 of magnet 86, which is included in a normally open shunt-circuit leading to the return-line 87. As the car moves along the contact-bar passes in contact with the point 42 of the branch conductor 43, as shown in said diagram, the large arrow indi-

cating the direction of movement of the car. The diagram represents the section 80 of the contact-bar as in circuit, which condition is brought about by the current flowing over the magnet 86 of said section by way of the dynamo or generator 88, which is located at a central station, thence the main conductor over the branch 43, contact-point 42, the contact-section 80, thence by wire 89 over the magnet 86 to the return-line 87, which may be an earth return. The passage of the current over the magnet attracts the armature thereof and thereby closes the switch-arm 84 over the motor-circuit, over which latter the current then flows and supplies the motor. By thus subdividing the contact-bar into electric sections of less length than the manholes and placing the latter sufficiently near together I propose to keep energized or alive only that section which is passing through a manhole. In this way the conduit intermediate the manholes may be reduced to a minimum size, that is, a size in which the contact device will just clear the walls of the conduit, for, as the parts of the contact device, which in such case will be moving through the conduit proper, will not be energized by the current, it matters not how near together such parts may lie, as all danger of arcing is avoided.

It is to be observed that the two trucks shown in the drawings need not necessarily be attached to the same car, as it is obvious that they may each form part of two adjacent cars.

Having thus described my invention, what I claim is—

1. The combination of a car having double trucks, a contact device suspended therefrom and consisting of a short conducting-bar supported horizontally beneath and between the axles of each truck, and an intermediate conducting-bar hinged between said short bars, substantially as and for the purpose set forth.

2. In an electric railway, the combination of a conduit provided with a manhole having a removable cover formed with an opening therein, and a detachable hood 77 fitting in said opening in the cover and formed with a downwardly-opening recess adapted to contain a set of fuses or the like, substantially as and for the purpose set forth.

3. In an electric railway, the combination of a car having double trucks, a contact device suspended from said trucks and consisting of a conducting-bar formed of laterally-flexible and vertically-inflexible sections hinged together on horizontal axes, supports depending from said trucks and said sections being fixedly attached to some of said supports and pivoted to others on a common axis with the hinge-joints of said sections.

4. In an electric railway, the combination of a car provided with trucks, a slotted conduit, a contact device depending from the car and traveling in the conduit, said contact device comprising a set of vertically-rigid and

laterally-flexible sections 4, 5 and 6, hinged together at 18 18 on horizontal axes, said device being supported from the car by members 7, 8, 9 and 10 depending from the trucks and connected with said contact device at points in the same vertical planes as the axles of the trucks and being hinged to the said members 8 and 9, respectively, at said points 18 18, substantially as and for the purpose set forth.

5. In an electric railway, the combination of a car, a contact device comprising a bar formed of horizontally-arranged sections hinged together and supported from the car rigidly at one point, pivotally at a second point, pivotally to a horizontally-sliding support at a third point and rigidly to a horizontally-sliding connection at a fourth point.

6. In an electric railway, the combination of a pair of four-wheeled trucks, a contact device mounted beneath said trucks and comprising a bar composed of horizontally-arranged sections hinged together, a support depending from or near each axle of said trucks, the support at one end being rigidly connected with said bar, the next said support being pivoted to said bar on an axis in alinement with the axis of one of said hinge-joints of said bar, the next said support being pivoted to a horizontally-sliding connection on an axis in alinement with the axis of a hinge-joint of said bar, and the next said support being connected to said bar by a horizontally-sliding connection.

7. In an electric railway, the combination of a car and a contact device suspended therefrom and comprising a bar formed in three sections hinged together on horizontal axes, one of said end sections being supported by horizontally-fixed joints, a sustaining-rod supported in fixed position parallel with the other end section, said latter section being connected with said sustaining-rod by horizontally-sliding joints.

8. In an electric railway, the combination of a slotted conduit having manholes at frequent intervals, a main conductor provided with branch conductors extending into said conduit and provided with suitable contact-points arranged one in each manhole, a car having a contact device extending through said slot into the conduit and comprising a bar formed in electrical sections of less length than the manholes, each of said sections being provided with an automatic switch for completing the circuit upon engagement of a contact-point by a section of the contact-bar and cutting it out when such connection is broken, whereby only that section of the bar in the manhole is electrically energized.

9. An electric switch comprising a rocking frame or plate provided with terminals, an oscillating contact-lever pivoted between its ends to a point on said frame or plate, and adapted to bridge said terminals when moved to one limit of its oscillation, means for holding said lever at its other limit of movement

against gravity but not with sufficient force to resist a sudden impact of the frame or plate against a fixed object when said frame or plate is rocked.

- 5 10. An electric switch comprising a rocking frame or plate provided with terminals, a spring for snapping said body or plate on its axis after the same is given an initial movement, an oscillating contact-lever pivoted between its ends and adapted to bridge the terminals when moved to one extreme limit of its oscillation, means for holding said contact-lever at its other limit of oscillation against gravity but not with sufficient force to resist the impact of said frame or plate against a fixed object when rocked.

11. A switch comprising a rocking frame or plate provided with terminals, an oscillating contact-lever pivoted between its ends and adapted to bridge the terminals when moved to one limit of its oscillation, said lever provided with weights to increase its momentum, means for holding said contact-lever at its other limit of movement against gravity but not with sufficient force to resist the impact of said body or plate against a fixed object when the same is rocked.

12. A switch comprising a rocking frame or plate provided with terminals, an oscillating contact-lever pivoted between its ends and adapted to bridge the terminals when moved to one limit of its oscillation, a friction device for holding said contact-lever at its other limit of movement against gravity, whereby the impact of said frame or plate upon the termination of its rocking movement may serve to release the contact-lever from said frictional device and throw it into connection with the terminals.

13. In an electric railway, the combination of a car provided with a contact device, a main conductor provided at intervals with branch conductors having suitable points of contact, a spring-actuated carrier for said contact-points normally holding the same in the path of said contact device and adapted to be pressed aside thereby against the action of its spring, a normally open switch located in each said branch conductor and comprising a rocking frame or plate provided with terminals, an oscillating contact-lever adapted to bridge said terminals when moved to one limit of its movement, means for holding said contact-lever at its other limit of movement against gravity but not with sufficient force to resist the impact of said frame or plate against a fixed object when the same is rocked, said carrier connected with said frame or plate of the switch and adapted to rock the switch when the carrier is pressed aside by the contact device and to return it to normal position when said contact device has passed off of the contact-point of said carrier.

14. In an electric railway, the combination of a car provided with a contact device, a main conductor having branch conductors at intervals each provided with a suitable con-

tact-point, a carrier for each of said contact-points consisting in a leaf-spring coiled at one end and secured by such end to a fixed point.

15. In an electric railway, the combination of a car provided with a contact device, a main conductor having branch conductors at intervals each provided with a suitable contact-point, a normally open switch located in each said branch conductor, a carrier for each of said contact-points consisting in a leaf-spring coiled at one end and secured by such end to a fixed point, the other end of said carrier being connected with and actuating the switch of its branch conductor.

16. In an electric railway, the combination of a car, a slotted conduit having contact-points located therein at intervals, a contact device traveling within said conduit and comprising a bar composed of sections 4, 5 and 6, hinged together at 18, 18, on horizontal axes, a set of supports 7, 8, 9 and 10, depending from the car through the slot into the conduit, said support 10, being connected rigidly to the section 6, a hinge connecting the lower end of said support 9, with the abutting ends of the sections 5 and 6, a hinge connecting the lower end of said support 8, with the abutting ends of said sections 4 and 5, the lower end of said support 7, being connected with said section 4, by a horizontally-sliding joint, substantially as set forth.

17. In an electric railway, the combination of a car, a slotted conduit having contact-points arranged therein at intervals, a contact device comprising a bar traveling within said conduit, supports 7 and 8, depending from the car into the conduit, a horizontal sustaining-bar 30, mounted upon said supports within the conduit and provided with slides moving lengthwise thereof, said slides connected with and sustaining said contact-bar, substantially as set forth.

18. In an electric railway, the combination of a car, a slotted conduit having contact-points arranged therein at intervals, a contact device comprising a bar made up of hinged sections traveling within said conduit, supports 7 and 8, depending from the car into the conduit, a horizontal sustaining-bar 30, secured to the said supports within the conduit and provided with slides moving lengthwise thereof, one of said slides connected rigidly to one of said sections of the contact-bar and another of said slides hinged to the abutting ends of said sections, the axis of said hinge being in alinement with the axis of the hinge between said sections.

19. In an electric railway, the combination of a main conductor provided at intervals with normally-disconnected branch conductors, each of which is provided with a contact-point adapted to be engaged by a contact device carried by a car, each contact-point being provided with a spring-carrier 48, having one end made fast and the other end free, and a normally open switch located in each said branch conductors and actuated by the

free end of its spring-carrier, substantially as set forth.

20. An electric switch comprising a rocking frame or plate having a prescribed range of movement and provided with terminals, an oscillating contact-lever, such as 58, for bridging said terminals, and springs 60 for holding said lever away from the terminals, substantially as set forth.

21. An electric switch comprising a rocking frame or plate having a prescribed range of movement and provided with terminals, an oscillating contact-lever, such as 58, for bridging said terminals, means for holding said lever away from the terminals against the action of gravity, but not with sufficient force

to hold it against the forcible movement of the frame or box, and a spring secured by one end to the frame or box out of alinement with the axis of the center of motion thereof and having the other end secured to a fixed point for snapping said box or frame through its prescribed range of movement after it has been given an initial movement, substantially as set forth.

In testimony whereof I have hereunto set my hand, this 20th day of July, 1893, in the presence of the two subscribing witnesses.

FRANK MANSFIELD.

Witnesses:

A. M. HAYES,

WILLIS FOWLER.