(No Model.) 5 Sheets—Sheet 1.

W. A. BUTLER.

ELECTRIC RAILWAY SUPPLY SYSTEM.

No. 523,104. Patented July 17, 1894.

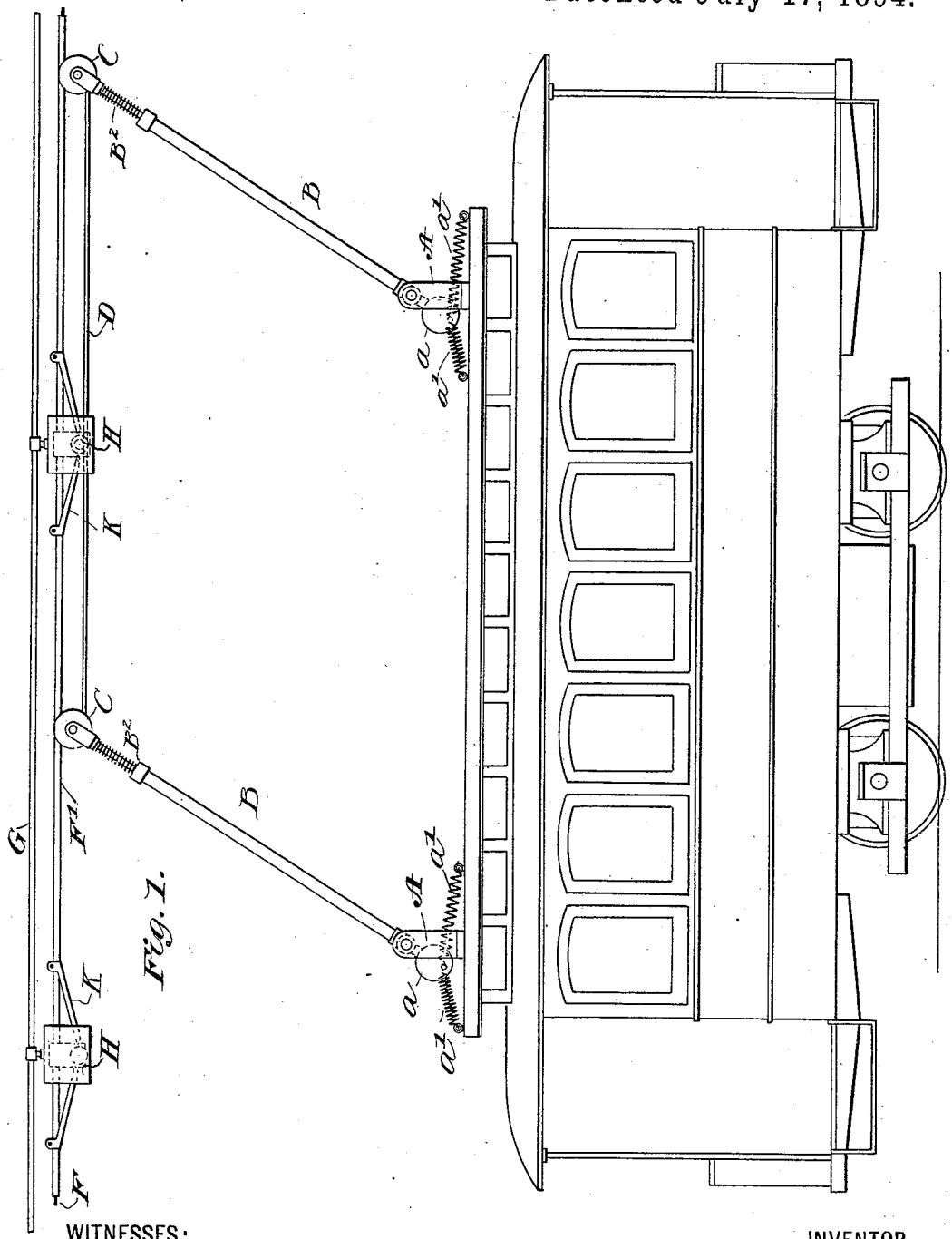

Fig. 1.

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Fig. 2.

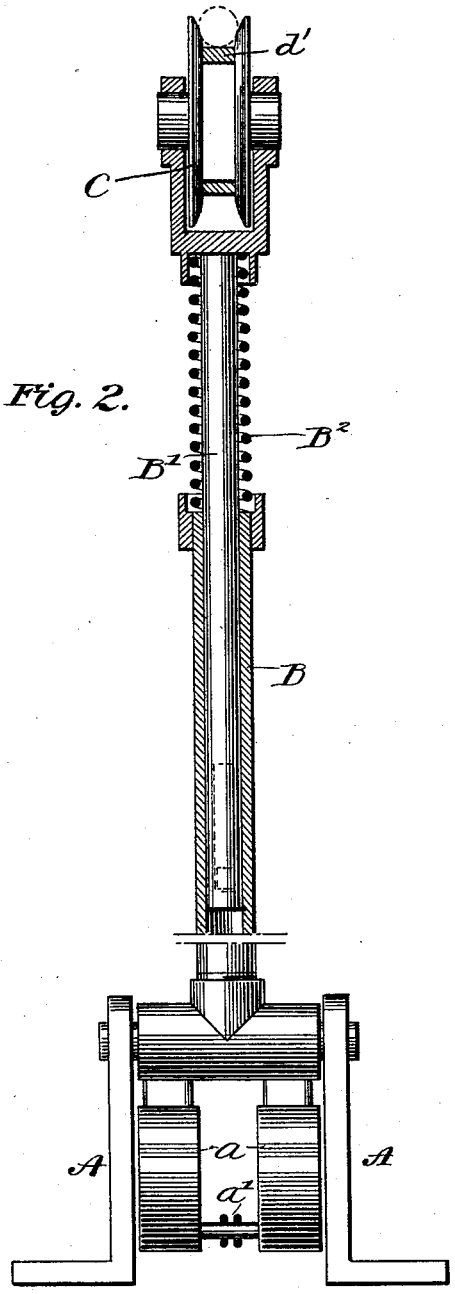
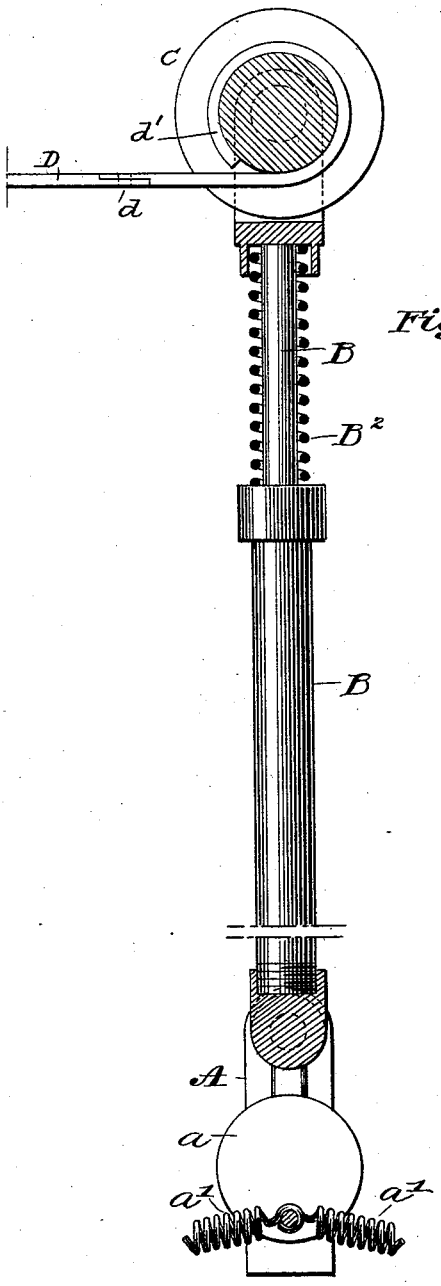


Fig. 3.



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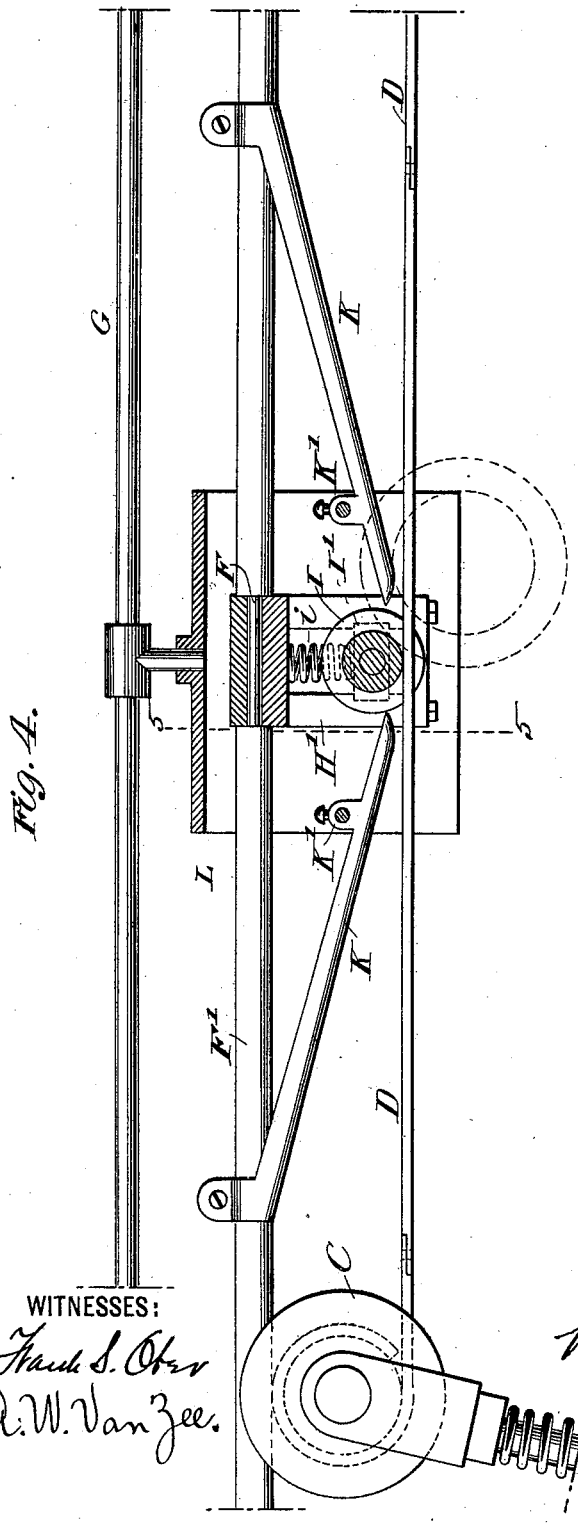

Fig. 4.

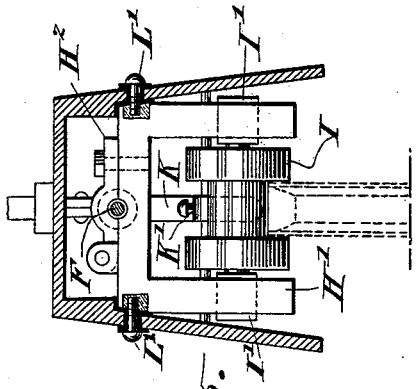

Fig. 5.

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ELECTRIC RAILWAY SUPPLY SYSTEM.

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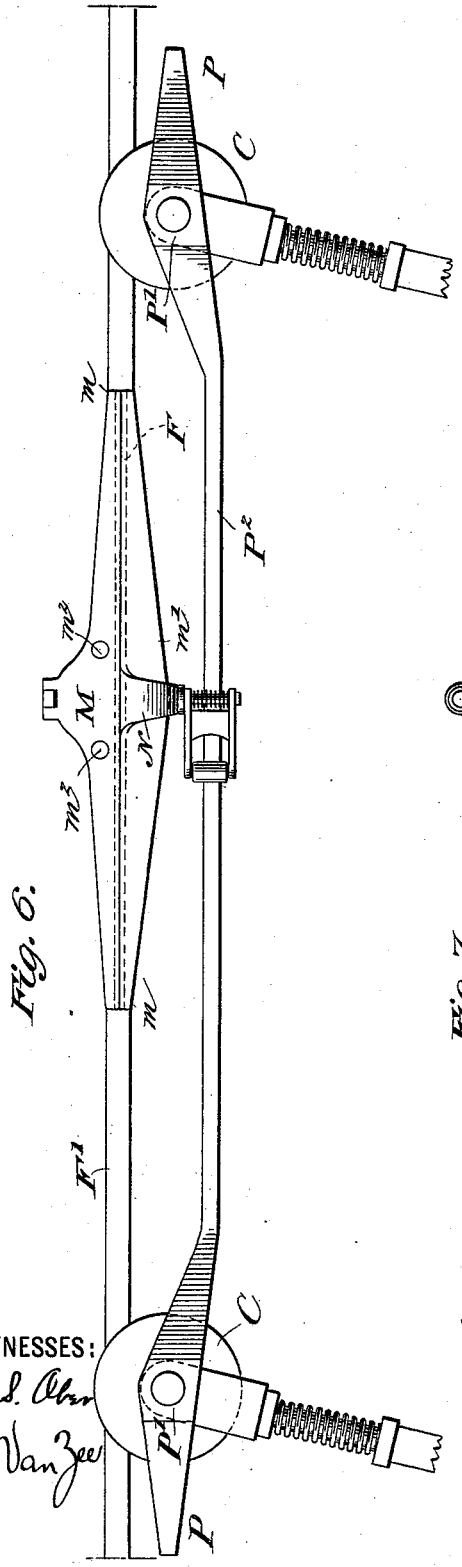

Fig. 6.

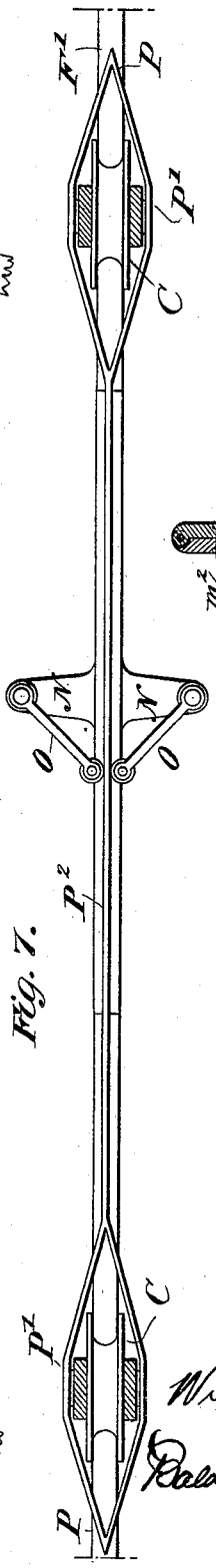

Fig. 7.

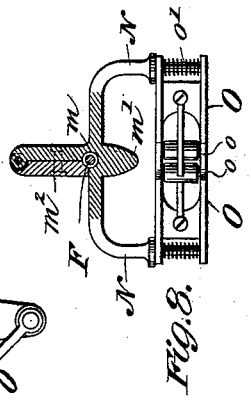

Fig. 8.

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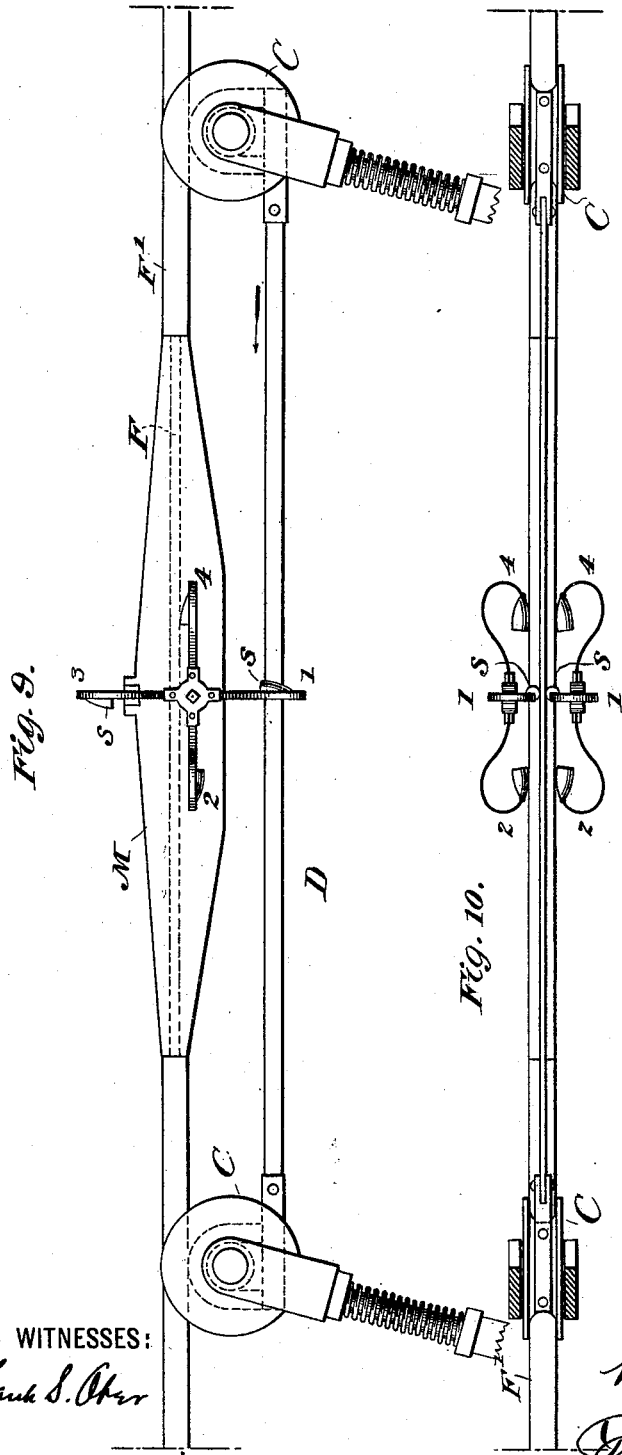

Fig. 9.

Fig. 10.

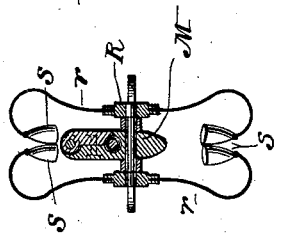

Fig. 11.

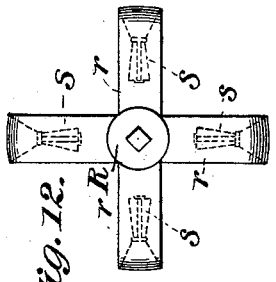

Fig. 12.

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UNITED STATES PATENT OFFICE.

WILLIAM A. BUTLER, OF NEW YORK, N. Y., ASSIGNOR TO JOHN GILMORE BOYD, OF SAME PLACE.

ELECTRIC-RAILWAY SUPPLY SYSTEM.

SPECIFICATION forming part of Letters Patent No. 523,104, dated July 17, 1894.

Application filed March 16, 1894. Serial No. 503,900. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM A. BUTLER, a citizen of the United States, residing in New York, county and State of New York, have invented certain new and useful Improvements in Electric Railways, of which the following is a specification.

My invention relates to that class of electric railways, in which the current for the motor on the car is taken from an overhead conductor or series of electrically charged contacts, by a contact shoe or device carried above the car; but it is distinguished from the ordinary overhead trolley system in that the overhead charged contacts, from which the current is taken, are located at intervals, and the contact brush or device carried above or at the top of the car is of such length as to make contact with one of such devices before leaving another so as to maintain a continuous circuit or supply of current through the motor.

I am aware that heretofore it has been proposed, as for instance in the patent of Thomson, No. 470,221, dated March 8, 1892, to employ an overhead conductor having pendulous contact arms, mounted thereon at intervals, the conductor being insulated between such devices, and that such pendulous switch or contact arms are to be struck by a conducting plate upon the roof of the car, so as to maintain a current through the motor as the car progresses, the conductor on the top of the car being of such length as to strike one of the pendulous arms before leaving the preceding one. I am also aware that in several instances, it has been proposed to arrange the distributing conductor underground, and at suitable intervals, to lead up branches from it, supported above the roadway at intervals by posts or standards, arranged either between the tracks or at the curb line, and so constructed as to support a series of separated contact devices above the track in the line of travel of the car, and that with such an organization it has been designed to employ an elongated conductor or brush carried above the car and adapted to strike the contact devices successively, and of such length as to make contact with one of said devices before leaving the preceding one.

The plan first referred to is objectionable, because of the uncertain action of the pendulous switch arm, due to the irregular motion of the car, and the variation in the elevation of the roof thereof, because of varying loads, inequalities in the track, and vertical vibration: aside from the fact that the pendulous contact arms suspended from the distributing conductor are unsightly and objectionable, since either the distributing conductor must be strung quite low, or the pendulous arms must be relatively long. As the contact plate carried by the roof of the car is horizontal, or substantially so, the surface becomes coated with dirt, snow and ice, and a good electrical connection between it and the pendulous switch arm is comparatively uncertain.

The second plan referred to is objectionable, for the reason that unless the conductor carried above the car is very wide horizontally, there would be, owing to the irregular movement of the car, difficulty in properly actuating the successive contact devices arranged above the track: and if the width of the contact plate, carried above the car, is depended upon to properly make contact with and actuate the separate contact devices, its contact face must be a horizontal one, and the system would then be open to the objections before stated, viz: the uncertainty of good contact due to accumulations of snow, ice and dirt. If the contact plate carried above the car is narrow, whatever may be its depth or width vertically, there would be, owing to the irregularities of motion of the vehicle, considerable uncertainty as to its establishing proper contact with the overhead contact devices.

In an ordinary overhead trolley system, these objections do not exist because the trolley wire may be strung at any desired elevation, and the trolley wheel is grooved so as to embrace it, and as the wheel is mounted upon an elongated yielding carrying arm, it must of necessity follow the wire. But the ordinary trolley system is objectionable because the bare or uninsulated electrically charged

overhead conductor is always a source of danger, either from the breakage thereof and the falling of the ends upon the roadway, or because of contact with it of other conductors such as those used for telephones, telegraph, and signaling purposes.

In my improved system, while retaining the certainty of action due to the use of a vertically yielding guide, which is preferably a grooved wheel, traveling upon a strained wire or guide, I obviate the objections to the other systems. In my system, I employ an elongated conductor or contact shoe carried at a suitable elevation above the car, and provided with one or more grooved guide wheels, and capable of yielding vertically to any desired extent, and at the same time having a slight sufficient lateral play. The grooved wheel or wheels moving with the shoe, run upon an overhead wire or guide, which may be the insulation covered charged conductor or may be a dead wire or guide. At suitable intervals, I employ contact devices electrically connected with the distributing conductor, with which devices the elongated shoe successively makes contact, contact with one of said devices being made before leaving the preceding one. The contact devices thus operated by the traversing shoe are so located that the shoe is guided to them in exact and proper relation by the guide wheel.

Obviously the contact devices may be arranged according to either of the plans referred to at the beginning of this specification, though for economy of construction, I prefer that they be carried directly upon the charged or distributing conductor, which is covered with insulation between them, and to avoid the abrasion of such insulation by the wheel or wheels running thereon, if necessary, the insulation may be protected by a winding of wire, or in any other suitable manner; and since the wheels are not necessarily a conducting part of the shoe, they may be made of vulcanized rubber, vulcanized fiber, wood, or other non-metallic material, which would not be so liable as metal to injure or abrade the insulation of the conductor. Should it be found that the contact devices to be attached to the wire add unduly to its weight, an additional supporting wire may be strung above it, and the two connected at intervals by suspending cords or links, which would preferably be of non-conducting material.

In the accompanying drawings, I have shown my invention embodied in several forms, which are those best known to me, but as is obvious the features of my invention may be embodied in other organizations differing more or less in detail from that hereinbefore suggested and hereinafter described in this specification.

Figure 1 is a side elevation, illustrating one form of the invention: Fig. 2 a view partly in section and partly in elevation, showing in detail one of the standards mounted on the top of the car, the guide wheel, and elongated conductor or contact shoe. Fig. 3 is a similar view of the same at right angles to Fig. 2. Fig. 4 is a detail view, partly in section, showing on a larger scale the insulated overhead conductor, a supporting wire, one of the contact devices attached to the insulated conductor and a portion of the contact shoe carried above the car. Fig. 5 is a cross-section through the same on the line 5, 5, of Fig. 4. Figs. 6, 7 and 8 are detail views showing a modified construction of the contact devices, mounted on the insulated charged conductor, and a modified form of contact shoe; and Figs. 9, 10, 11 and 12 are detail views showing other modifications of the same parts or devices.

On the roof of the car, near the opposite ends thereof are brackets A A in which are pivoted vertical standards B, the pivots being horizontal and transverse to the line of travel of the car. The short end or extension of the standard below the pivot is weighted as at a, so that the standard tends normally to occupy a vertical position, and to accentuate this tendency, springs a' suitably arranged and connected may be employed. I prefer that the standard shall be in two parts, one B′ telescoping within the outer tubular part B, and normally pressed upwardly by a coil spring B^2. In a head on the upper end of the part B′ is mounted a guide wheel C, of any suitable material, having a grooved periphery. The wheels thus mounted on each standard are connected by a conductor D, which may be jointed as at d to give it flexibility laterally. Each end of the conductor is coiled or bent around the face of the pulley at the bottom of the groove or recess, as seen at d', but embraces it loosely so as not to interfere with its free rotation. The groove in the wheel may be of such depth, and so shaped, that the wire upon which it runs as presently described, will not bear upon the coiled end d' of the elongated conductor or shoe D, which embraces the pulley.

F indicates a charged or distributing insulated conductor, F′ the insulation surrounding it, and G a strained supporting wire, while H H indicate the contact boxes or devices arranged at intervals on the insulated charged wire.

The details are seen more clearly in Figs. 4 and 5, in which H′ represents a yoke or inverted U-shaped frame, which is clamped directly upon the conductor F, from which the insulation has been removed at this point, by a hinged arm H^2 secured by a suitable screw bolt, or otherwise. The top of the frame or yoke H′, and the inner face of the hinged arm H^2 are formed with opposite grooves, in which the bared conductor F is clamped. I prefer that these faces shall be coated with lead to insure good contact and exclude air and moisture from, and to prevent consequent oxidation of the surfaces of contact. The contact wheel I preferably having a grooved periphery, as clearly indicated in Fig. 5, is shown as mounted in boxes I′, having a ver-

tical movement in the forked sides of the frame or yoke H′, the boxes I′ and wheel I being normally pressed downwardly by coil springs *i*. The surfaces of contact of the moving parts being of sufficient area, there will be good electrical connection between the wheel I and the conductor F. On each side of the contact box H, I secure to the insulated conductor F, without however removing the insulation, guides K. These guides are in width about equal to the diameter of the insulation, and inclined downwardly to a point in line with or slightly below the normal position of the axis of the conducting wheel I, the guides being supported at their lower ends by cross-pins K′, mounted in the sides of a hood or cover L, open at the bottom and both ends, but otherwise enveloping the contact devices H. The sides of this hood are bolted to the yoke or frame H′ by insulated bolts L′, and the hood or cover L is supported by the strained supporting wire G. In this organization, it is desirable that the wheels C shall be conductors and shall be in electrical connection with the elongated conductor or shoe D. As the car proceeds, the wheels C travel upon the insulated conductor F, the leading wheel strikes the guide K, and it is deflected downwardly, finally passing from it into contact with the contact wheel I, thence to the opposite guide K, and thence to the insulated wire again. This final position is that shown in Fig. 4. As the leading wheel C leaves the contact roller I, the shoe D is brought into contact with said roller, and a continuous circuit from the charged conductor F to the wheels C and shoe D is maintained, until the rear roller C has passed the contact roll I. The current may be led to the motor on a car in any suitable manner. I have not thought it necessary to illustrate in detail either the motor or the connections leading from the shoe to it.

The contact bar or shoe D will, in practice, be about twenty feet, more or less, in length, and the contact devices H H will be located at such intervals that the leading wheel C will make contact with one contact roller I, before the rear wheel C has left the contact roller immediately in the rear.

It is obvious that the details of this organization may be varied, and that the practical application of the principles therein involved will be obvious to those skilled in the art, and that proper provision may readily be made for turning curves, by multiplying the joints in the conductor, or shoe D, or otherwise constructing it so that it shall have sufficient lateral flexibility. The hood or cover L is intended, not only to protect the parts of the contact device H from exposure to the elements, but is also intended to so envelop it that in the event of the breakage of the wires, or the falling of the devices, the electrically charged parts will be covered and the liability of injury to persons or animals in the street reduced to a minimum. In the modified constructions, which I will now describe, similar hoods or covers may be employed, but I have not thought it necessary to illustrate them.

In Fig. 6, I have shown an elongated coupling M, tapered at both ends *m* to a diameter about that of the insulation of the conductor F. It is relatively long and narrow, and its lower edge *m′* is rocker shape, and it is designed to receive and guide the grooved wheels C of the contact shoe. Its upper half is composed of two longitudinal parts, one hinged to the other, and adapted to be clamped upon it and against the bared conductor F by screws or bolts m^2. In this case also the socket for the reception of the conductor F is preferably faced with lead. From opposite sides of the coupling M, at or about its middle, it is formed with arms N that project outwardly, and then downwardly, the lower ends thereof serving as vertical journals for two pivoted arms O, carrying rollers *o* at their ends. Spiral springs *o′* surrounding the journals tend to bring the arms O into the position indicated in Fig. 8, that is, they are at right angles to the insulated conductor F, and preferably slightly overlap as indicated. In this organization I employ a contact shoe or brush of somewhat different character than that already described. The telescoping standards and wheels C may be practically the same as before described, except that the elongated conductor is pointed at each end and bifurcated so as to pass on each side of the wheel C. This is indicated clearly in Fig. 7, where P indicates the wedge shaped or pointed end of the shoe, P′ the bifurcations or sides of the opening therein, and P^2 the body of the conductor extending between the bifurcated end portions. In side elevation, I prefer that the conductor or shoe P, P′, P^2, shall be shaped substantially as shown in Fig. 6. As the car traverses the track, the leading wheel C passes from the insulation of the wire F on to the reduced end *m* of the coupling M, and as it traverses along the lower edge of the coupling, the point T of the contact shoe forces open the spring controlled arms O O of the contact device, and the rollers *o o′* run upon the sides of the shoe, thus completing the circuit from the charged conductor F, through the shoe to the motor on the car. It is equally obvious that in this modified construction, the details may be varied to meet the requirements of any particular case by those skilled in the art, without departing from my invention. Of course the central portion P^2 of the contact shoe may be sufficiently flexible to allow of running around curves of any radius.

In Figs. 9, 10, 11 and 12, I have shown an organization in many respects resembling that last described, and corresponding parts are correspondingly lettered. The elongated shoe or conductor D in this case is supported upon the wheels C C in substantially the manner indicated in Fig. 4, except that its greatest depth or width is vertical instead of hori-

zontal. The coupling M is substantially the same as that illustrated in Fig. 6, but the contact devices proper, which bear upon the shoe D are constructed differently and as follows:— A short shaft R is journaled transversely in the coupling M about its middle, and from this shaft project radially corresponding pairs of curved spring arms *r*. The ends of the arms are preferably curved outwardly somewhat, and then backwardly toward the axis and in or on the end of each arm there is journaled a contact roller S. These rollers are preferably tapered at the ends farthest from the axis R, and the two rolls of the arms of a pair normally bear against each other or are in close proximity to each other. I have shown four such pairs of radial bars equipped with contact rolls, though a greater number may be employed if desired. The operation is as follows, and for the purposes of the description of this operation, I have in Fig. 9 numbered the pairs of radial arms 1, 2, 3, 4. Assuming that the leading wheel C is approaching the contact device, and that the direction is that indicated by the arrow, and that the pair of radial arms marked 2 occupy the position in which the pair marked 1 appear in the drawings; the leading wheel C, which may be of insulating material will strike the depending arms 2, and turn them up into the position indicated in Fig. 9, while at the same time the pair of arms marked 1 will be forced downwardly into the position indicated in the drawings, and in this movement the conducting shoe D will press the rolls S S apart and these two rolls will then bear upon the sides of the conductor D as seen in Figs. 9 and 10. The parts occupy this position, and the current from the charged conductor F is transferred through the motor on the car, while the shoe D is passing between the rollers S S of the pair of arms 1. The rear wheel C passes under the arms 4, and striking the arms 1 moves them out of the way, up into the position occupied by the arms 2 in Fig. 9, while the pair of arms 4 will at the same time be turned down in a position to be struck by the leading wheel C of the next car.

The shoe or conductor D may consist of one conducting plate or wire or of two or more arranged parallel with each other and all electrically connected. The exterior of the coupling M, in the several modifications shown, may be coated with insulating material, for instance, with vitreous enamel, and similarly all the exposed parts of the radial arms, the hubs in which they are mounted and the ends of the journal may also be similarly insulated. When therefore the revolving contact devices are made as indicated in Fig. 12, the rollers or contact devices S thereof will be protected by the relatively wide arms, and in the event of such a device as that shown in Fig. 9 falling on account of the breakage of the wire, the current carrying parts will be well covered and danger of accident avoided, or as before stated a protective hood of insulating material may be employed.

It is obvious that in all the organizations I have described cars may be run in either direction, and that the contact shoe will conform to the line of the insulated conductor F, and that all irregularities of distance, due to vibration of the car, or inequality in its movement from any cause, or variations in the position of the conductor F, will be compensated by the construction of the yielding standards that carry the elongated conductor or contact shoe D.

I claim as my invention—

1. In an electric railway system, overhead contact devices, arranged at intervals and mechanically connected by a guide, in combination with an elongated conductor carried by a car and having one or more guiding devices which follow said guide, substantially as set forth.

2. In an electrical railway system, a series of contact devices arranged above the roadway at intervals and connected by a guide, in combination with an elongated conductor carried by a car, and having one or more grooved wheels running upon said guide, substantially as set forth.

3. In an electric railway system, a series of contact devices arranged at intervals above the roadway, and mechanically connected by a strained guide wire, in combination with an elongated conductor carried by a car, and having one or more grooved guide rollers that run upon the strained wire, substantially as set forth.

4. In an electric railway system, an overhead conductor surrounded with insulation and having contact devices mounted thereon at intervals, and electrically connected therewith, in combination with an elongated conductor carried by a car and having one or more grooved guide rollers running upon the insulated overhead conductor, substantially as set forth.

5. In an electric railway system, an overhead conductor surrounded with insulation and having arranged thereon at intervals contact devices clamped directly upon the conductor at intervals (the insulation at such points being removed), in combination with an elongated conductor carried by a car and having one or more guide wheels running upon said insulated conductor, substantially as set forth.

6. In an electric railway system, an overhead conductor surrounded with insulation and having arranged thereon at intervals contact devices supported upon the conductor, (the insulation at such points being removed,) in combination with an elongated conductor carried by a car, having one or more guide wheels running upon said insulated conductor, and a protecting and insulating shield arranged over each of said contact devices,

and open at the sides and bottom, to permit the passage of the elongated conductor and its guide wheel or wheels.

7. In an electric railway system, an overhead conductor surrounded with insulation, and having arranged thereon at intervals contact devices clamped directly to the bared conductor, said devices having guiding surfaces forming guiding continuations of the exterior of the insulated conductor, in combination with an elongated conductor carried by a car, and having one or more guide wheels running on the insulated conductor, and guide surfaces, substantially as set forth.

8. In an electric railway system, an overhead conductor surrounded with insulation and having at intervals contact devices electrically connected therewith, in combination with an elongated conductor carried by a car, and having one or more guide wheels adapted to run upon the insulated conductor, substantially as set forth.

9. In an electric railway system, an overhead insulated conductor, having arranged thereon at intervals, couplings (M) clamped directly on the bared conductor, and provided with tapering ends, and guide surfaces forming continuations of the exterior of the insulated conductor, and electric contact devices carried by or mounted on said coupling, in combination with an elongated conductor carried by a car, having one or more guide wheels adapted to run upon the insulated conductor, and upon said guide surfaces, substantially as set forth.

10. In an electric railway system, an overhead conductor surrounded with insulation and having electrically connected therewith at intervals, contact devices consisting of radial contact arms revolving upon a horizontal axis transverse to the axis of the insulated conductor, in combination with an elongated conductor carried by a car, and having one or more guide wheels adapted to run upon said insulated conductor, and in passing the contact devices to move the radial contact arms, to establish electrical connection between them and the elongated conductor, substantially as set forth.

11. In an electric railway system, the overhead insulated conductor, a coupling M, clamped thereupon, and pairs of radial contact arms equipped with rolls and revolving upon a horizontal axis transverse to the axis of the insulated conductor, in combination with an elongated conductor carried by a car and having one or more guide wheels running upon said insulated conductor, and adapted to operate the pairs of radial contact arms to establish electrical connection between them and the elongated conductor, substantially as set forth.

12. In an electrical railway system, the combination with a car, of standards arranged above the car and at each end thereof, each standard being extensible endwise, mounted on a pivot, transverse to the line of travel of the car, and weighted beneath the pivot, whereby they tend to assume a vertical position, guide rolls carried in the upper end of each standard, and an elongated conductor extending between the guide rolls, substantially as set forth.

13. In an electric railway system, the combination with a car, extensible standards mounted on the top thereof each on a pivot transverse to the line of travel of the car, and provided with weights that tend to bring them to a vertical position, a guide wheel carried at the upper end of each standard, an elongated conductor extending between the guide wheels, an overhead conductor surrounded with insulation, and contact devices arranged thereon at intervals, and electrically connected therewith, the guide wheels on the standard being adapted to run upon said insulated conductor, and to guide the elongated conductor carried by the car to said contact devices.

14. In an electric railway system, the combination with a car, of pivoted uprights or standards arranged at each end thereof, and carrying guide wheels at their upper ends, an elongated conductor extending between the guide wheels, an overhead insulated conductor surrounded with insulation, and contact devices electrically connected therewith and mounted thereon at intervals, substantially as and for the purpose set forth.

15. In an electric railway system, overhead contact devices arranged at intervals and a guide extending between them, in combination with an elongated conductor carried by a car and having one or more guiding devices which follow said guide, substantially as set forth.

In testimony whereof I have hereunto subscribed my name.

WILLIAM A. BUTLER.

Witnesses:

EDWARD C. DAVIDSON,

FRANK S. OBER.