(No Model.)

R. LUNDELL.

ELECTRIC RAILWAY.

No. 551,334. Patented Dec. 10, 1895.

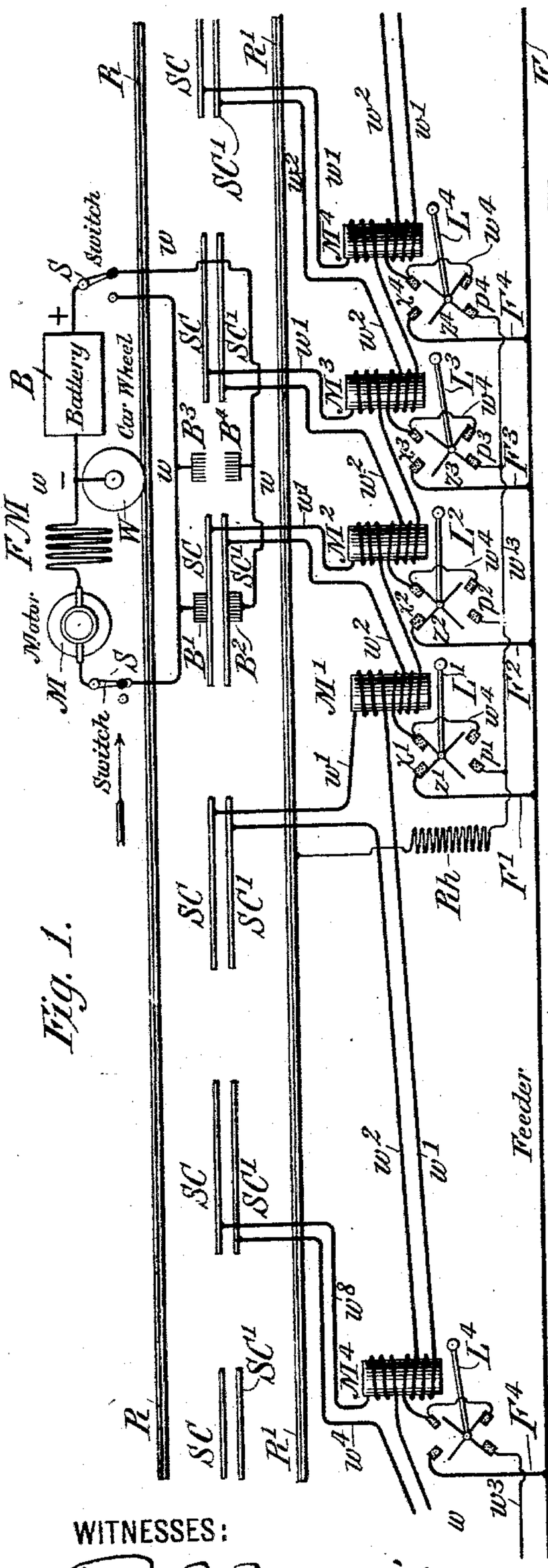

Fig. 1.

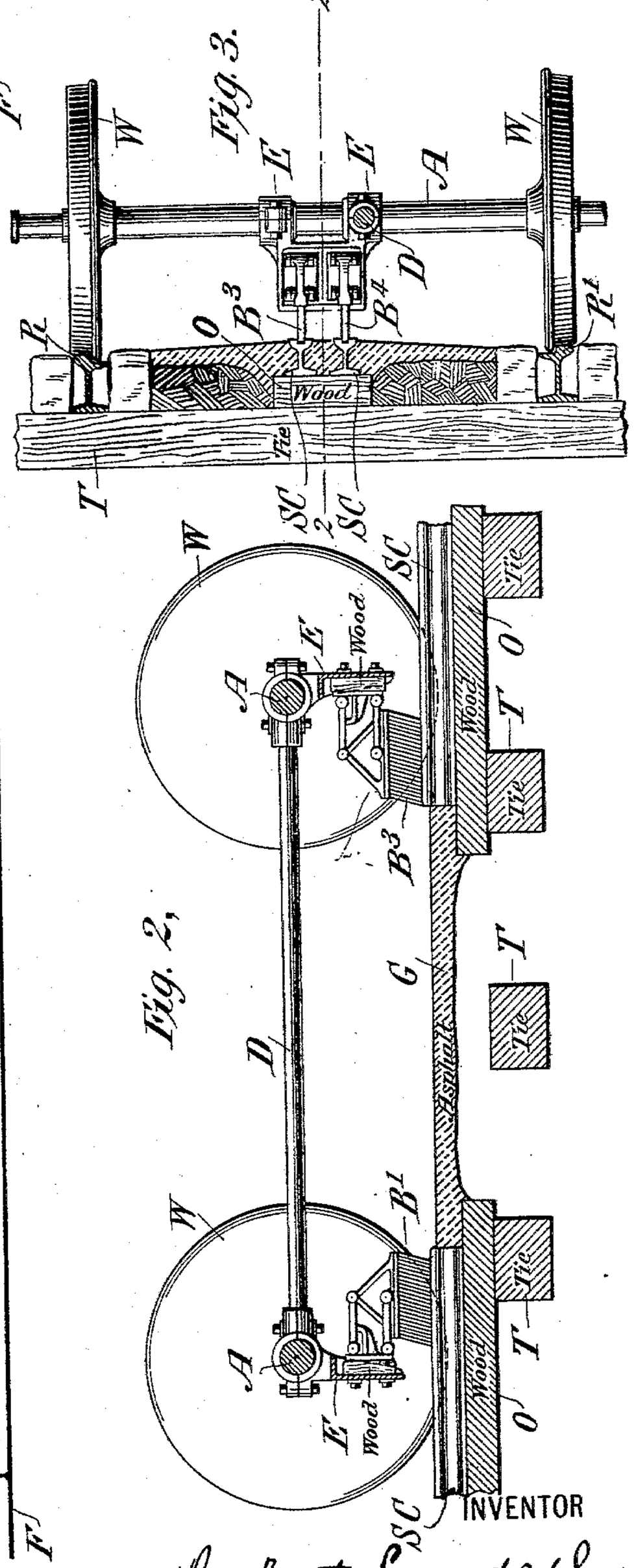

Fig. 3.

Fig. 2.

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ROBERT LUNDELL, OF BROOKLYN, ASSIGNOR TO THE JOHNSON SUBTROLLEY COMPANY, OF NEW YORK, N. Y.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 551,334, dated December 10, 1895.

Application filed June 9, 1894. Serial No. 514,069. (No model.) Patented in England July 17, 1894, No. 13,765; in France July 17, 1894, No. 240,115; in Italy August 20, 1894, No. 271; in Spain August 28, 1894, No. 16,075; in Austria February 15, 1895, No. 525, and in Germany July 26, 1895, No. 84,206.

To all whom it may concern:

Be it known that I, ROBERT LUNDELL, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have made a new and useful Improvement in Electrical Railways, of which the following is a specification.

My invention is directed particularly to improvements upon apparatus disclosed in prior United States patents granted to Edward H. Johnson, of New York, N. Y., and myself, jointly, on the 17th day of July, 1894, and numbered respectively 523,164, 523,165, and 523,166, the subject-matter of said patents and of the present application being also patented in the following foreign countries, to wit: Great Britain, No. 13,765, dated July 17, 1894; Italy, No. 271, dated August 20, 1894; Spain, No. 16,075, dated August 28, 1894; France, No. 240,115, dated July 17, 1894; Austria, No. 525, dated February 15, 1895, and Germany, No. 84,206, dated July 26, 1895.

The objects of the present invention are, first, to simplify and cheapen the cost of the entire structure or apparatus; second, to further decrease the liability of leaving any sectional trolley conductor connected to the current-feeder or main after a car has passed over it; third, to minimize the actual wear and tear upon the conducting-trolley or contact-brushes which collect the current from the sectional trolley conductors; fourth, to avoid the use of sliding crossings for the trolley or contact-brushes at the juncture of the tram-rails with other like lines of tram-rails; fifth, to render the operation of the switching devices certain and to avoid the fusing of the working contacts thereof; sixth, to accomplish any and all of the functions or results naturally attributable to the entire apparatus hereinafter described, the essentially-novel features of which are particularly pointed out in the claims at the end of the following specification.

Referring now to the drawings, in which like letters of reference represent like parts wherever used, Figure 1 is a diagrammatic view illustrating an electric-railway system embodying my improvements, and Fig. 2 is a vertical sectional view taken on the line 2 2, Fig. 3, which in turn is a transverse sectional view taken through Fig. 2, both of said views illustrating the manner of fixing the sectional trolley conductors in the center of the road-bed and also the manner of supporting the contact-brushes or trolleys beneath the car and from the axles thereof in accordance with my improvement.

R and R′ represent tram-rails of usual pattern and F an insulated current-feeder or main preferably buried beneath the road-bed, F′, F^2, F^3 and F^4 being insulated branch feeders or mains connected thereto and running to normally-open switching-contacts x', x^2, x^3 and x^4 and switch-operating electromagnets M′, M^2, M^3 and M^4 provided with switch-actuating armature-levers L′, L^2, L^3 and L^4 carrying each two sets of conducting contact-springs z', z^2, z^3, and z^4 adapted to make front contact with fixed contacts x', x^2, x^3 and x^4 and rear contact with similar fixed contacts p', p^2, p^3 and p^4, each having circuit connections with a conductor w^3 through a rheostat R^h to the rail R′ and earth, all of said magnets, armature-levers, contacts and the rheostat R^h being located in a water-tight switch-box in the same manner as disclosed in the prior patents above referred to. In the present invention, however, I locate four switch-magnets and circuit connections in each switch-box instead of three and I do away with the high-resistance shunt-electromagnets described and claimed in prior patents above referred to, the electromagnets M′, M^2, M^3, and M^4 having energizing-coils of few convolutions and large current-carrying capacity and adapted to act only for currents approaching the quantity of current required to operate the propelling-motor, thereby avoiding the probability of operation from leakage, as was possible with the shunt-magnets referred to, which might act for a current-leakage of small quantity. The coils of these electromagnets are connected directly to pairs of iron sectional trolley conductors SC SC′ of T-rail type secured in the center of the road-bed upon a longitudinal stringer O of creosoted wood carried by the ties T T. These

trolley conductors are separated from each other a sufficient distance to offer the necessary current-resistance when flooded with water. They are preferably grooved and a good conductor of copper fixed in each groove, the ends being separated from adjacent pairs of like conductors by spaces of about four feet each. The intervening spaces are preferably asphalt, as is the entire road-bed, and they are of lower level than the sectional conductors SC SC′, so as to avoid contact with the contact-brushes or trolleys B′, B², B³ and B⁴ as they pass off said conductors.

M represents the armature and FM the field-magnets of the propelling electric motor, W W the wheels, and B a portable source of electrical energy, as a storage-battery, said motor and battery being shown connected in multiple by a conductor *w* and switches S S to the wheel W and contacting brushes or trolleys B′, B², B³ and B⁴, four in number, carried by rigid arms E E E E journaled directly upon the axles A A of the car and connected by one or more rigid rods D, the arrangement being such that the brush-supporting arms partake only of the vertical movement of the car-axles.

The contacting brushes or trolleys B′, B², B³ and B⁴ are made of metallic strips secured to metallic brush-heads which in turn are carried by links or arms pivoted to supports secured through wooden blocks by bolts and oblong bolt-holes to the arms E E, said arms having at their lower ends each a rest or support as clearly shown which limits the downward movement of the brush-sustaining links. It is the function of these rests or supports to carry the brushes bodily above and out of contact with the asphalt when they leave the ends of the sectional trolley conductors or when riding over the rails of crossing tramways, which it will be noted will occur as the upper surfaces of the conductors SC and SC′ are noticeably higher than the level of the rails. With such an arrangement, therefore, I avoid the construction of especial crossing apparatus and effect a material cheapening in the cost of the apparatus as well as a saving in the wear of the brushes.

Referring again to Fig. 1 and to the circuits and winding of the switching-electromagnets, it will be seen that each sectional trolley-conductor SC is connected directly to the coils of two adjacent electromagnets in series relation and that the first and last magnet in each group are connected similarly and also that each sectional trolley conductor SC′ is connected directly to one coil of the magnet which controls the circuits for that particular sectional conductor, the arrangement being such that as the brushes B′ B² and B³ B⁴ bridge the spaces between the succeeding pairs of conductors the switches will be actuated in succession and little or no arcing occur at the switching-contacts *x′*, *x²*, *x³*, *x⁴* and *p′*, *p²*, *p³*, and *p⁴*, which contacts are all preferably of carbon or equivalent non-fusible material. I find that carbon or non-fusible contacts possess great merit in these positions in that they avoid any possibility of sticking or fusing together of the switch-contacts.

The operation will be fully understood on inspection of Fig. 1, in which a car is supposed to be passing from left to right, the propelling-current passing from feeder F by sub-feeder F′, fixed carbon contacts *x′*, movable contact-springs *z′* carried by armature-lever L′, lower coil of electromagnet M′, upper coil of electromagnet M², (energizing both of said magnets and maintaining their armatures in their upper or active positions as shown) conductor *w′* to sectional trolley conductor SC, contacting brush or trolley B′, conductor *w*, rear switch S, motor M, FM, wheel W through rail R to earth and to the other pole of the power-house generator. (Not shown.) A multiple or branch circuit is simultaneously closed as follows: From the central coil of magnet M′ by conductor *w²*, sectional trolley-conductor SC′, contact-brush or trolley B², conductor *w* to front switch S through the storage-battery B to wheel W and to earth as before, thereby supplying said battery with a charging-current. As the armature-levers L′ and L² are drawn forward the normally-closed high-resistance earth or safety circuits are broken and as the car passes on they are successively closed. At the same time the movable contact-springs *z²* carried by armature-lever L² were put into contact with the fixed carbon contacts *x²* and the next pair of sectional trolley conductors SC and SC′ in advance connected in circuit and adapted to convey current as soon as the brushes B³ and B⁴ shall pass upon them. Should the circuit be actually ruptured at any time by opening the rear operating-switch S, or as would be the case at a crossing or at some point where the sectional conductors were discontinued, then the car could of course be propelled directly by the storage-battery B or equivalent portable source of current-supply carried thereon by simply changing the front switch to its rear position so that the battery-current will all flow directly through the motor. On arriving at a section of the roadway provided with sectional conductors SC SC′ the switches S and S would be again placed as shown, and the battery-current would actuate the first switch-magnet put in circuit and the car proceed as before under control of the power-house-generator current.

I have shown simple switches S S for controlling the circuits to the battery motor and generator, but of course any preferred form of switch might be used. In fact I should prefer to use my improved circuit-controller disclosed in connection with the systems covered by our prior patents above referred to.

It will be understood also that the usual fuse-plugs would be provided for the various circuits running to the electromagnets in the

switch-boxes (not shown) and that they would be so arranged that should an abnormal current leakage occur they would be "blown."

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In an electric railway a current feeder or main, two sets of sectional trolley conductors arranged in pairs, normally open branch feeders running from the current feeder or main to switches controlled by electro-magnets, circuit connections from one of each pair of sectional trolley conductors through two of the switch operating electro-magnets in series and from the other trolley conductor of each pair to one of said magnets, substantially as described.

2. An electric railway provided with a current feeder or main, branch feeders running therefrom to switches controlled by electro-magnets, sectional trolley conductors arranged in pairs and connected one of each pair to its own switch operating magnet and the other to the same magnet and to the next adjacent magnet, substantially as described.

3. An electric railway provided with a current main and branch feeders running therefrom to switches controlled by electro-magnets, the coils of adjacent magnets being connected together, in combination with two rows of sectional trolley or service conductors permanently connected to the coils of the electro-magnets and by means of trolley or contact brushes having connection with the propelling motor and a battery on the car.

4. In an electric railway of the described class the combination of sectional service conductors and electro-magnetic switching devices so connected and arranged that the service conductor next in advance to the one which supplies the current is made alive and ready for service before it has been reached by the traveling contact brush or trolley.

5. In an electric railway of the described class the combination of two rows of sectional service conductors and electro-magnetic switching devices so connected and arranged that the service conductor next in advance to the one which supplies the current is made alive and ready for service before it has been reached by the traveling contact brush or trolley.

6. In an electric railway the combination of one or more motors and a battery on the car, contact brushes and sectional service conductors adapted to be connected to a supply conductor by means of electro-magnetic switches the coils of which at the starting moment are connected in series with the battery and the motor and at the next moment carry the current from the supply conductor to the motor and to the battery, substantially as shown.

7. In an electric railway a current feeder or main, sectional trolley conductors and switching devices for connecting them to the feeder or main in sequence; said switching devices having their controlling electro-magnets connected together; an earth circuit connection for each sectional trolley conductor and additional switching devices for rupturing said earth circuits, all of the switching devices being provided with non-fusible contacts whereby fusion or sticking of the parts is avoided.

8. Two or more contact brushes or trolleys carried each by a depending arm journaled on independent axles of a car and connected together by a rigid rod, each of said arms being provided with a rest or support for limiting the downward movement of the brush or trolley carried thereby.

In testimony whereof I have hereunto subscribed my name this 8th day of June, 1894.

ROBERT LUNDELL.

Witnesses:

CHARLES J. KINTNER,

M. M. ROBINSON.