No. 676,108. Patented June 11, 1901.

G. WESTINGHOUSE, JR.

ELECTRIC RAILWAY SYSTEM.

(Application filed June 21, 1890.)

(No Model.) 2 Sheets—Sheet 1.

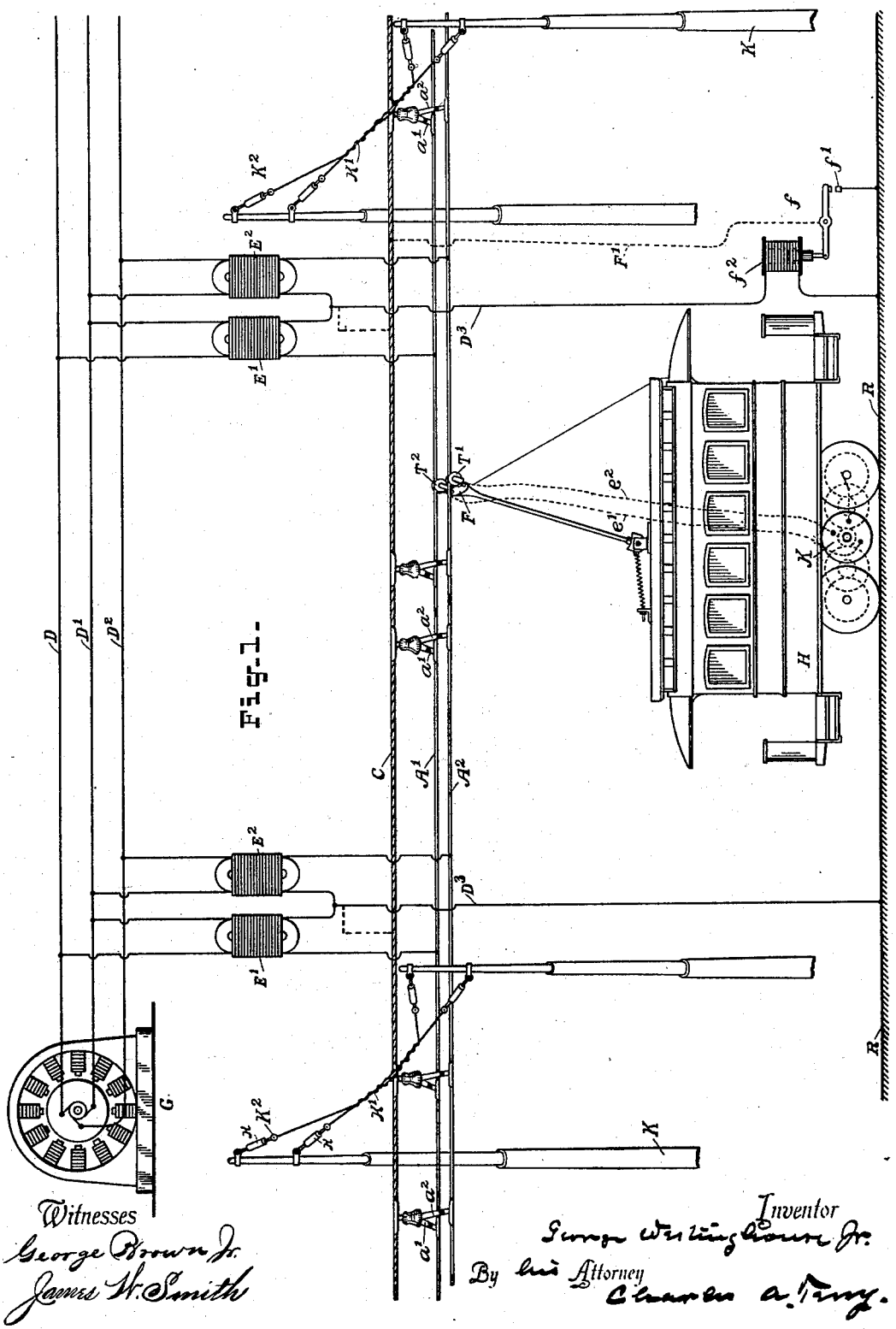

Fig. 1.

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Fig. 1.

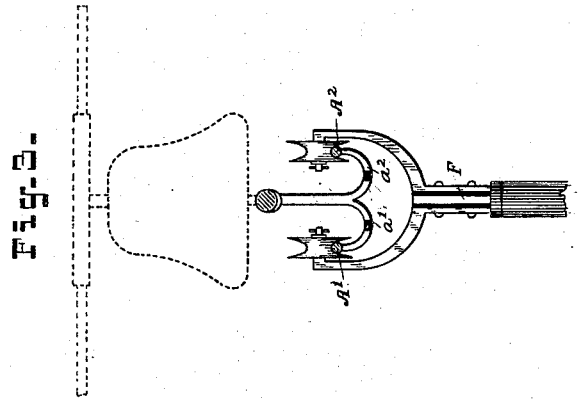
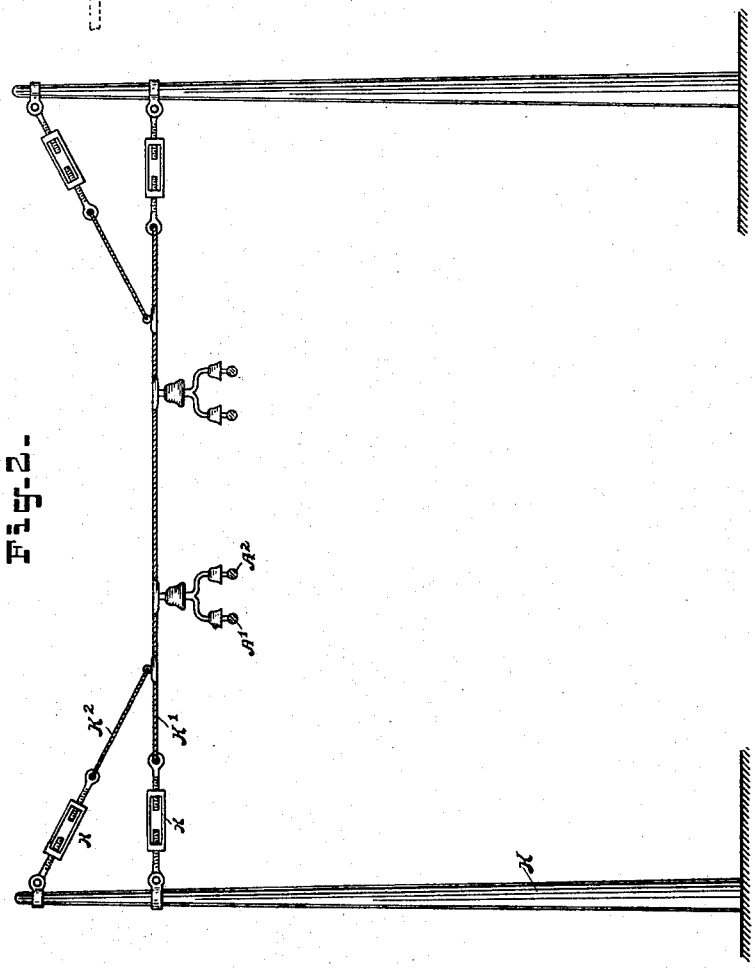


Fig. 2.



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UNITED STATES PATENT OFFICE.

GEORGE WESTINGHOUSE, JR., OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, OF SAME PLACE.

ELECTRIC-RAILWAY SYSTEM.

SPECIFICATION forming part of Letters Patent No. 676,108, dated June 11, 1901.

Application filed June 21, 1890. Serial No. 356,237. (No model.)

To all whom it may concern:

Be it known that I, GEORGE WESTINGHOUSE, Jr., a citizen of the United States, residing in Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a certain new and useful Improvement in Electric-Railway Systems, (Case No. 405,) of which the following is a specification.

My invention relates to the organization of circuits and conductors for electric-railway systems; and it has for one object to provide a convenient and serviceable system of circuits for supplying the required currents for operating electric-railway motors and one which shall obviate the liability of accidents by reason of accidental contacts being made with the conductors and the consequent short-circuiting of the same.

A further object of the invention is to provide for the neutralizing of the induction upon the different conductors in case alternating currents are used in the system.

The invention will be described in connection with the accompanying drawings, in which—

Figure 1 is a view showing an electric-railway system embodying my improvements. Fig. 2 is an elevation of one set of poles and span and guy wires in a modified system, and Fig. 3 is a detail view showing a modified form of conductor-supporting hanger.

Referring to Fig. 1 of the drawings, A′ A^2 represent two copper or other suitable conducting wires for conveying the electric currents. These are supported at intervals by brackets or hangers a' a^2. These brackets or hangers are suspended from a continuous wire or cable C, which serves not only as a support and guard for the conductors A′ A^2, but, being a continuous conductor, it may, if desired, be employed to complete the circuit between the generator and motor, or it may be connected to earth at intervals, and thus serve to ground the current carried by any live conductor that may come in contact therewith. The hangers or brackets a' a^2 will be located at proper intervals to firmly support and maintain the conductors A′ A^2 in their proper relative positions. The wire C is supported by means of span-wires K′ and guy-wires K^2, both of which are attached to posts or other suitable supports K, located at convenient points along the line. The span-wires K′ are connected to the poles at points somewhat below the connections of the guy-wires therewith, and both sets of wires may have interposed tension devices k, if desired, as shown more clearly in Fig. 2. In Fig. 1 the guy-wires are shown as wrapped or wound about the span-wires, and in Fig. 2 they are shown as attached to the span-wires by means of clips. Any other means of attachment may be employed, if desired. It will thus be seen that the three wires C A′ A^2 are formed by means of the brackets or hangers into a single substantial structure and that this structure is firmly supported by means of the poles that span the guy-wires above described. When it is desired to turn a corner, it is merely necessary to so arrange the span and guy wires as to cause the wire C to form the proper curve, and the conducting-wires A′ A^2 will necessarily follow the same curve. If desired, stiff rods may be employed as working conductors at the curves, in which case they will stand up rigidly without requiring extra span-wires. The conductors A′ A^2 may be formed in sections, if desired, as shown in Fig. 1, and when so formed currents will be supplied thereto from outside continuous conductors, such as those illustrated at D D′ D^2, for example. In such a system by employing currents of very high electromotive force the conductors D D′ D^2 may be small in cross-section and a great saving in material be thus effected. In the drawings I have shown a system organized for the well-known three-wire Tesla system of motors, in which the generator G delivers currents upon the two circuits formed by the conductors D D′ and D D^2, and the converters have their primaries connected in these circuits. The supporting-conductor C may be entirely insulated, and thus serve as the return-conductor, if desired, or it may be connected to the earth through the span and guy wires and poles, and thus serve in part as the return-conductor, or it may be employed merely as a guard and safety-con-

ductor in case any foreign live conductor should come into contact therewith. In the drawings it is shown as connected to the earth through the span and guy wires and poles, and I have shown by dotted lines connection between the same and one of the poles of the secondary of each converter. This latter is an alternative construction, however, the connection of the secondaries of the converters with the earth directly being shown in full lines, the other terminals of the converters being in each case connected with the wires A' A^2, respectively. In case it should be desired in any instance to make a more complete ground connection when a car is passing along a section of the conductor than is furnished through the span and guy wires and poles a conductor F' may be employed. This conductor is connected with a contact lever *f*, the contact-point *f'* being connected to the earth. An electromagnet or solenoid f^2 is connected in the earth-conductor D^3, so that when a car is upon the corresponding section and currents are caused to traverse the conductor D^3 the solenoid-core attached to one end of the lever *f* will be drawn into the solenoid and the ground-circuit from conductor C completed.

While I have described the system with special reference to the use of sectional conductors and alternating currents, it is obvious that the conductors A' A^2 may be continuous, if desired, and that continuous currents may be employed. In operating the system trolley-wheels T' T^2, supported upon a suitable carrier F, are employed, and these trolley-wheels are insulated from each other, as shown more clearly in Fig. 3. Electrical connections may be made from these trolley-wheels to the motor in any convenient manner. I have shown for convenience conductors *e' e²* by dotted lines for conducting the current from the trolley-wheels to the motor. In operating the system of electric railways by these conductors it is evident that one of the conductors may be connected to one terminal of the source of electricity and the other with the remaining terminal and the electric motors connected in parallel between the conductors by means of the trolleys. It will be observed in the structure described that the conductors A' A^2 are shielded by the conductor C in such manner as to ordinarily prevent other conductors which may fall from above from making contact therewith; but as the supporting-conductor C may not and usually will not be insulated from the ground any foreign conductor which happens to fall upon the structure and to come into contact with either of the working conductors and to connect that conductor with the earth will cause no injury to any person touching the foreign conductor, for the reason that there will be formed a ground or earth connection through the conductor C. Should such foreign conductor lead into a building, injurious electric currents will not be led in, for the reason that the circuit will be already completed to the earth through the conductor C.

I have illustrated upon the track R a car H, having an electric motor K of the type known as the "Tesla motor," the currents being delivered thereto by the means and in the manner hereinbefore described. By reason of the employment of the two parallel conductors conveying alternating currents the annoyance caused by induction to telephone-lines is obviated, since the currents in the two circuits tend to neutralize any external effects of that character.

In Fig. 2, which is designed mainly to show the tension devices in connection with the span and guy wires, I have shown a system in which the brackets or hangers for supporting the working conductors are connected directly to the span-wire; but I prefer the construction in which the supporting wire or cable C is used in connection with the span and guy wires for supporting the brackets and working conductors.

In Fig. 3 I have shown an arrangement of conductors suitable for use in connection with overrunning trolleys, the arms of the brackets *a' a²* being turned upward and supporting the conductors A' A^2 at their ends.

While I have described specific means for carrying on my invention, I do not desire to be limited thereto, as various modifications may be made in the details of the system without departing from the spirit of my invention.

I claim as my invention—

1. The combination with a suitably-supported, continuous, grounded conductor provided at intervals with brackets or hangers, of two parallel working conductors insulated and supported from said grounded conductor by said brackets or hangers, substantially as described.

2. In an electric-railway system, the combination with a suitably-supported, continuous, grounded conductor provided with brackets or hangers, of a plurality of sectional, working conductors insulated and supported from said grounded conductor by said brackets or hangers, substantially as described.

3. The combination with a suitably-supported, continuous, grounded conductor provided with brackets or hangers having upwardly-turned arms, of two parallel working conductors supported upon the ends of said upwardly-turned arms, substantially as described.

4. In an electric-railway system, the combination with a plurality of working conductors and a supporting-conductor therefor, of a normally open circuit including said supporting-conductor and the earth, and a circuit-closing device for automatically closing said normally open circuit upon the passage of a car, substantially as described.

5. In an electric-railway system, the com-

bination with a suitably-supported conductor forming part of a normally open earth-circuit, of a working conductor supported therefrom and a circuit-closing device for completing said earth-circuit upon the passage of a car, substantially as described.

In testimony whereof I have hereunto subscribed my name this 11th day of June, A. D. 1890.

GEO. WESTINGHOUSE, JR.

Witnesses:
W. D. UPTEGRAFF,
CHARLES A. TERRY.