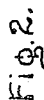


959,919.

2 SHEETS—SHEET 1.



Murray D Badgley
Helen Arford

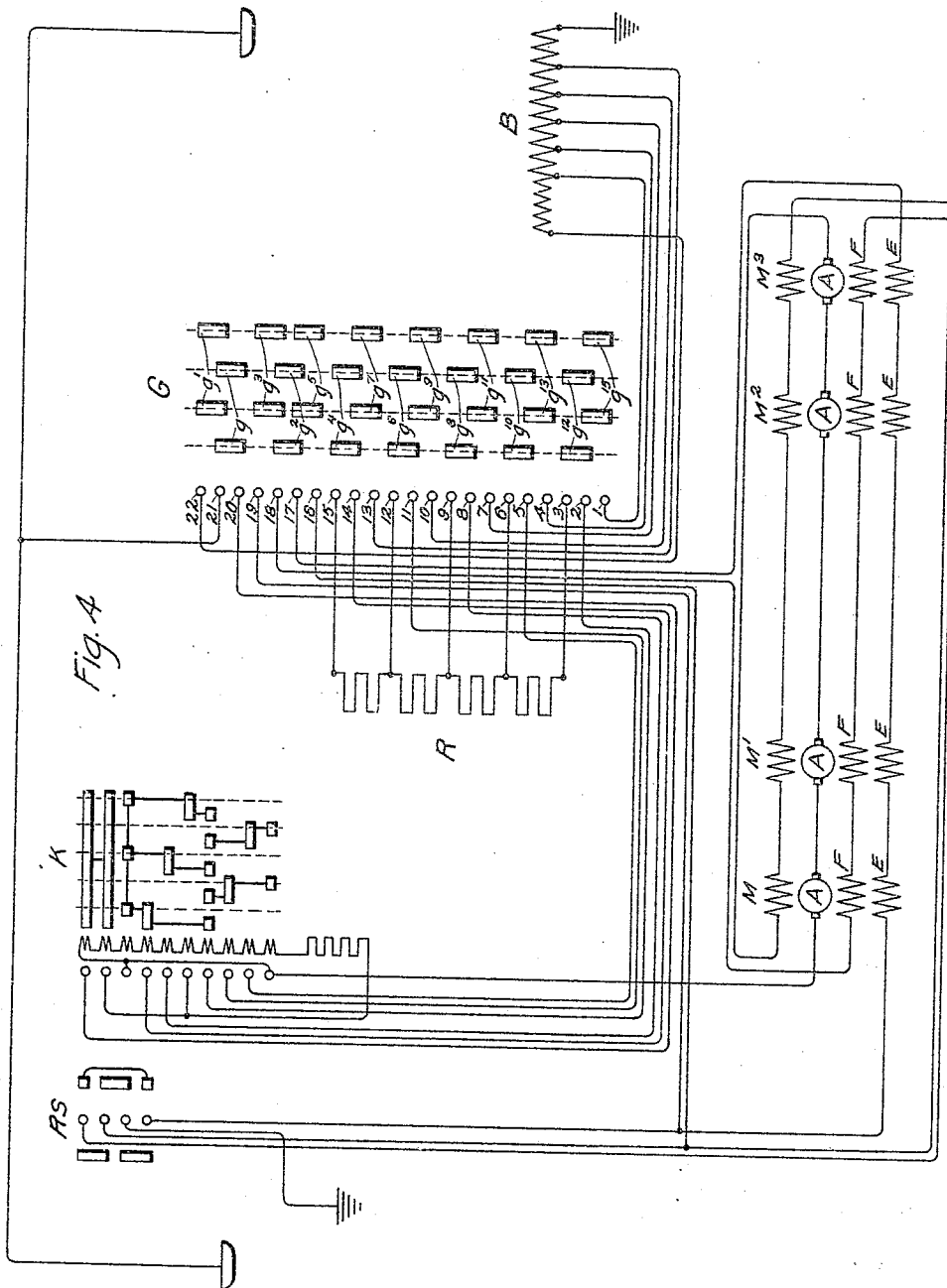
ANDREW B. GRAHAM CO. PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

F. E. CASE.
ELECTRIC RAILWAY SYSTEM.
APPLICATION FILED NOV. 29, 1905.

959,919.

Patented May 31, 1910.

2 SHEETS—SHEET 2.



Witnesses:
Murray D. Badgley
Helen Crawford

Inventor:
Frank E. Case
By *Alfred H. Davis*
Att'y.

UNITED STATES PATENT OFFICE.

FRANK E. CASE, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRIC-RAILWAY SYSTEM.

959,919.

Specification of Letters Patent.

Patented May 31, 1910.

Application filed November 29, 1905. Serial No. 289,591.

To all whom it may concern:

Be it known that I, FRANK E. CASE, a citizen of the United States, residing at Schenectady, county of Schenectady, and State of New York, have invented certain new and useful Improvements in Electric-Railway Systems, of which the following is a specification.

The present invention relates to electric railways and particularly to systems wherein different portions of the line are energized by current differing in character, as, for example, one section being supplied with alternating current and another section with direct current. In such combined alternating and direct current systems it is customary in passing from one section to another, to vary the connections of systems of the motor windings in order to make the motors operate efficiently on either current; and also where, as is usually the case, the alternating current is of high potential and is transformed to a current of low potential by transformers on the cars the connections between the motor circuits and the current collecting devices must be changed in passing from one section to another in order to include or exclude the transformer, as the case may be. Heretofore these operations have been effected manually in whole or in part at least, thereby requiring the attention of the motorman during the passage from one section to another.

The object of the present invention is to so construct and arrange the parts of the system of the character described that all the desired changes in the motor circuit and in the connections between the motor circuits and the collecting devices may be automatically made while the car is going from one section to another.

Further object of the present invention is to insure the deenergization of the car circuits at the time the circuit changes are made in order that there may be no flow of current except under the proper circuit conditions.

To the above ends I have provided switch mechanisms on the cars adapted to make the proper circuit changes, together with means for automatically operating these switch mechanisms as the cars pass from one section to another. The deenergization of the car circuits during these changes are insured by providing a dead section of considerable length intermediate the supply sections and

causing the operation of the switch mechanisms to take place while the cars are traversing the dead sections, and thus all danger of operating these switch mechanisms inadvertently is obviated. If the dead section has any substantial length a car may at times come upon it without having sufficient momentum to carry it across, thus causing the car to come to rest on the dead section.

The present invention further contemplates means for temporarily energizing the dead section in order that a car may be made to start up under its own power in case it should come to rest on the dead section.

Further objects of the invention will appear in the following description thereof taken in connection with the accompanying drawings showing preferred forms.

Reference being had to the drawings, Figure 1 shows a portion of a railway system arranged in accordance with the present invention, one car being illustrated in the act of passing between adjacent sections; Fig. 2 is a detail; Fig. 3 illustrates diagrammatically circuits of a single car and the switch mechanism for changing the connections of said circuits; and Fig. 4 illustrates diagrammatically one car equipment having switch mechanism arranged not only to change the connection of the motor circuit of the supply conductor but also to alter the electrical condition of the motor circuit.

Similar reference characters indicate corresponding parts throughout the specification and drawings.

1 indicates a car running upon rails 2 and having a trolley or other current collecting device 3 which engages with a supply conductor 4; 5 and 6 indicate respectively the adjacent ends of two sections of the supply conductor which are energized by currents differing in character; 7 is a short section connected to but insulated from the sections 5 and 6. At any convenient point intermediate the ends of the section 7 is located a stop or projection 8 arranged to strike against the arms of a star wheel carried by the car. The star wheel is connected to and operates the circuit changing switch mechanism on the car as will be hereinafter described. Assuming that the car is leaving section 5, the car circuit is deenergized by reason of the collecting device entering upon dead section 7, and thereafter one arm of the star wheel 9, striking against the stop 8,

produces a rotation of the star wheel through a definite angle. This movement of the star wheel and connected mechanism changes the various circuits and connections so that when the collecting device comes into engagement with 6 the equipment is ready to operate on the particular current supplied by this section.

The dead section 7 need be of such length only as to insure the operation of the switch mechanism while the current collecting device is isolated from the supply sections and ordinarily, therefore, the car may pass beyond the dead section by virtue of the momentum acquired before reaching it. In case, however, the car should come to rest upon a dead section, it is desirable that some means be provided for supplying it with current in order that it may proceed under its own motive power. To this end I have provided means for temporarily connecting the dead section to either section 5 or section 6, as by means of a double throw switch 10 which is arranged to connect wire 7^a either to wire 5^a or to wire 6^a. By using a single switch it is made impossible for the operator to connect sections 5 and 6 together. The movable member of the switch 10 is also preferably held in a central inoperative position normally by means of springs 11, so that the section 7 will not remain energized inadvertently after the switch has been operated to permit a car to proceed.

In Fig. 3, M¹ and M² indicate two car motors, C a motor controller and T a transformer. S is a switch, the movable member of which is connected to the star wheel 9, and this switch is provided with contacts s¹ and s² which either connect the current collecting device directly to the motor circuit or make the connection through the transformer T. In the one case the primary of the transformer is cut out while in the other it is connected to trolley.

In Fig. 4 I have illustrated a four-motor car equipment arranged to operate on alternating and direct currents, the system being provided with a commutating switch which connects the motor circuit either directly to trolley or to a compensator and at the same time changes the relative connections of the field windings and provides connections whereby the motor controller may respectively insert variable amounts of resistance in the motor circuit or connect the motors to different points on the compensator. This system is the same as that set forth in Patent No. 806,752 granted on the 5th day of December, 1905, on an application filed by Jesse S. Pevear, except that in the present case the commutating switch has no "off" position and is provided with two direct current running positions and two alternating current running positions. Also, in the present system the main switches are incor-

porated in the commutating switch instead of being separate therefrom. The contacts are so located that each rotation of the cylinder through 90° effects the circuit changes necessary when changing from one current to another.

The four motors are indicated by M, M¹, M² and M³, and each motor has an armature A and main field coils E and F. G is the commutating switch and R S the reversing switch. K is a controller for governing the speed of the motors either by varying the amount of the resistance R in the motor circuit or by varying the point of connection of the motor circuit with the compensator B. These parts and their organization are the same as in the patent referred to and will not be described at length herein. The commutating switch comprises fixed contacts 1—22; two rows of movable contacts, g¹, g³, g⁵, etc. to g¹⁵; and two rows of movable contacts, g, g², g⁴, etc. to g¹². The movable contacts are mounted upon a cylinder which is illustrated in developed form, as is also the controller cylinder. When either of the series of contacts g—g¹² are in engagement with the fixed contacts the motors are arranged to be connected directly to trolley in series with resistance R and with the field coils E and F in series with each other. When either of the other two series of movable contacts is in engagement with the fixed contacts, the compensator B is introduced between the motors and trolley and the field windings E and F are connected in parallel with each other. It is of course understood that the commutating switch G is adapted to be operated through the engagement of a star wheel or other device with the stop 8 as previously described, so that all the circuit changes are made automatically as the car traverses the dead section.

What I claim as new, and desire to secure by Letters Patent of the United States, is,—

1. In an electric railway, two adjacent supply conductor sections energized by currents differing in character, an intermediate section between said supply sections and insulated therefrom, and a switch for electrically connecting said intermediate section either of said supply sections.

2. In an electric railway, two supply conductor sections energized by currents differing in character, an intermediate conductor section between said supply conductor sections and insulated therefrom, and a switch for connecting said intermediate section electrically to either of said supply sections and arranged to prevent said intermediate section from being connected electrically to both supply sections at the same time.

3. In an electric railway, two supply conductor sections energized by currents differing in character, an intermediate conductor section between said supply sections and

insulated therefrom, a switch and connections to connect said intermediate section electrically to either supply section, and means for normally maintaining said switch
5 in an inoperative position wherein said intermediate section is disconnected electrically from both supply sections.

4. In an electric railway, two supply conductor sections, an intermediate conductor
10 section between said supply conductor sections and insulated therefrom, a stop or projection arranged adjacent the roadway between the ends of said intermediate section for operating switch mechanism on a car
15 traversing said intermediate section, and means for electrically connecting said intermediate section to either of said supply conductor sections.

5. In an electric railway, a track, supply
20 conductor sections energized by currents dif-

fering in character, a normally dead conductor section intermediate said supply sections, a car having a motor or a group of motors adapted to be operated by current
25 from either supply section, switch mechanism arranged to vary the electrical conditions of the motor circuit, and the connection between the motor circuit and the supply conductors, means located at a fixed
30 point along said track for automatically operating said switch mechanism while the car is on the dead section, and a switch for electrically connecting said dead section to either of said supply conductor sections.

In witness whereof, I have hereunto set
35 my hand this 28th day of November, 1905.

FRANK E. CASE.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.