No. 890,198. PATENTED JUNE 9, 1908.

L. H. THULLEN.

ELECTRIC RAILWAY.

APPLICATION FILED MAR. 2, 1906.

2 SHEETS—SHEET 1.

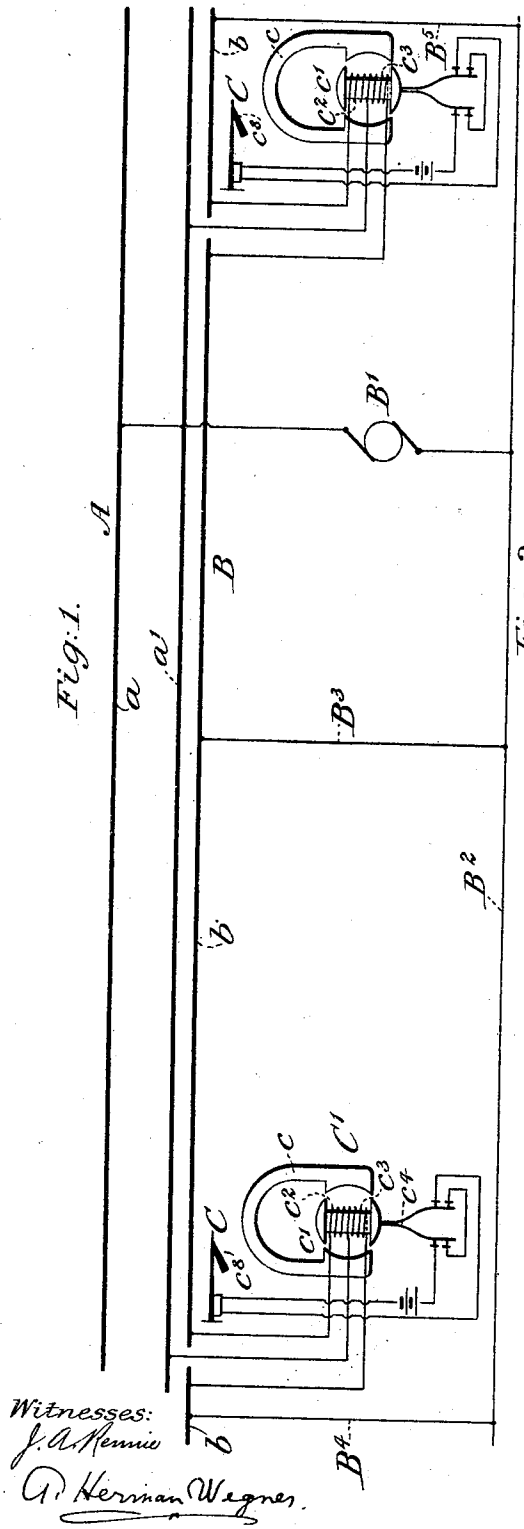


Fig. 1.

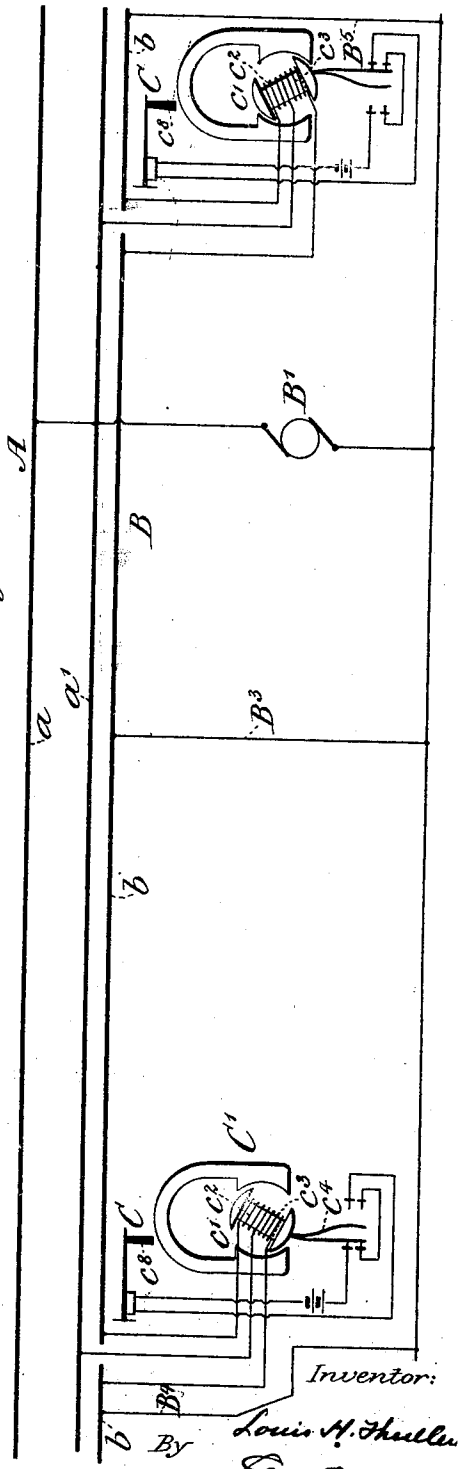


Fig. 2.

Witnesses:
J. A. Kennie
G. Herman Wagner.

Inventor:
Louis H. Thullen
By
Fred E. Crane
his Attorney.

No. 890,198. PATENTED JUNE 9, 1908.

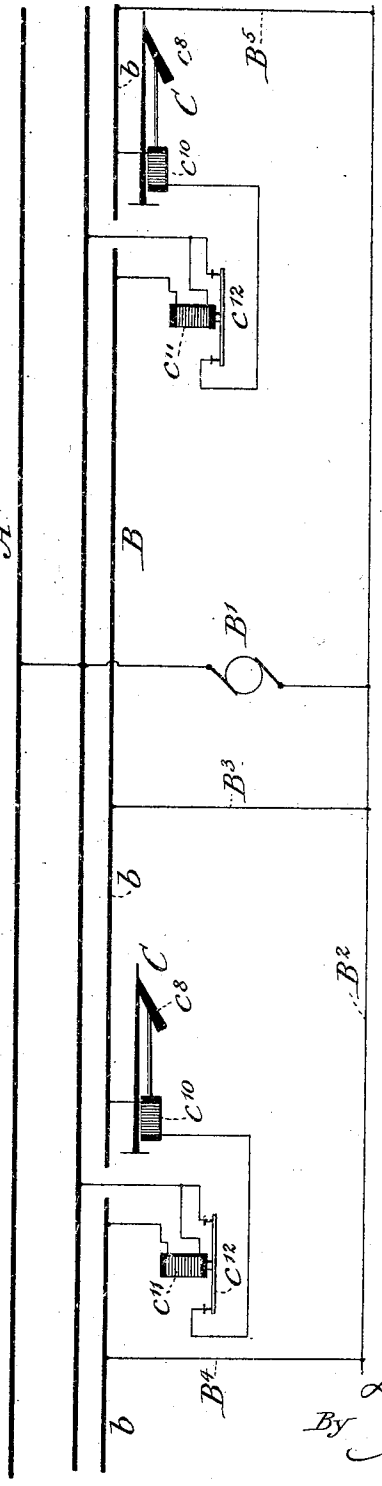
L. H. THULLEN.

ELECTRIC RAILWAY.

APPLICATION FILED MAR. 2, 1906.

2 SHEETS—SHEET 2.

Fig. 3.



Witnesses:
J. A. Rennie.
G. Herman Wegner.

Inventor:
Louis H. Thullen
By Fred E. Greene
his Attorney.

UNITED STATES PATENT OFFICE.

LOUIS H. THULLEN, OF EDGEWOOD, PENNSYLVANIA, ASSIGNOR TO THE UNION SWITCH & SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

ELECTRIC RAILWAY.

No. 890,198. Specification of Letters Patent. Patented June 9, 1908.

Application filed March 2, 1906. Serial No. 303,774.

To all whom it may concern:

Be it known that I, LOUIS H. THULLEN, a citizen of the United States, residing at Edgewood, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements Relating to Electric Railways, of which the following is a specification.

My invention relates to improvements in electric railways and more particularly to a means for indicating the electrical potential condition of a section of a working conductor for the car propulsion current. In many instances it is necessary to form the working conductor into sections or to break its continuity at points. Under such circumstances it is advisable that some means be provided which will indicate to a motorman whether or not there is sufficient potential in the sectional conductor which he is approaching to operate his car or train, or whether the difference in potential between the two sections is excessive, in which case the current will blow fuses in his train or cause other trouble.

I will describe an electric railway embodying my invention and then point out the novel features thereof in claims.

In the accompanying drawings, Figure 1 is a diagrammatical view of a portion of a railway, sections of a working conductor for car propulsion current and a means for indicating whether or not potential exists in the sections of the feeder conductor. Fig. 2 is a view similar to Fig. 1 but indicating a different condition. Fig. 3 is a view similar to Fig. 1 but illustrating a modification.

Similar reference characters designate corresponding parts in all of the figures.

Referring to the drawings—A designates a portion of a railway, the track or running rails a, a^1 are included in or form part of the return path or conductor for the car propulsion current. The track rails, one or both may or may not be divided by insulation to form block sections for signaling purposes.

B designates a working conductor, third rail or trolley and b, b, b, sections thereof.

B^1 designates a power generator for supplying the working sections b, b, b through conductors B^2, B^3, etc. These sections may or may not be of equal length, as desired. In some cases it may be preferable to only section the conductor B at points where conditions are such that a continuous conductor could not be used. The working conductor B whether continuous or in sections is designed to have an electrical potential substantially the same at all points (not considering the "line drop") and the power station and sub-power stations are so arranged as to accomplish this. Consequently, should the working conductor B be divided into sections, all the sections thereof would have the same potential. In this event the means which I provide at the section points will be operated or balanced to indicate this condition and these means will preferably be adjusted to or protected against the line drop. Should, however, this condition of equal or substantially equal electrical potential between the section change or vary for any cause, the means (my invention) will indicate this fact.

The means which I employ comprises a visible or audible indicator C and a relay or translating device C^1 for controlling the indicator. As shown, the indicator C is in the form of a semaphore blade and is actuated by a suitable automatic mechanism c^8, of which there are many. The operating circuit which, for the mechanism c^8, includes a source of current, is controlled by the relay C^1. When the local or operating circuit is closed, the indicator C assumes a position indicating to the motorman that the sections of the feeder are or nearly are, of the same and sufficient potential to operate his car or train. This condition is illustrated in Fig. 1. When the operating circuit is open, the indicator assumes a position indicating to the motorman that the potential of the section is not the same as the other sections of the feeder conductor.

The relay C^1 is of a type of motor comprising a field c, and an armature c^1 which, as shown, comprises two windings of the same number of turns c^2, c^3. The armature c^1 is arranged to rotate or oscillate within the field. When equal currents are flowing through these windings simultaneously the armature will assume one position relatively to the field and when unequal currents are flowing through the windings simultaneously the armature assumes another position relatively to the field. In the position assumed by the armature when equal or substantially equal currents are flowing through the windings (see Fig. 1) an arm c^4 carrying spring contacts is made to keep closed the operating

circuit of the indicator C, and in the position assumed by the armature when unequal currents are flowing through the windings the arm c^4 is made to open the operating circuit of the indicator C. One winding c^2 is in circuit with a section b of the working conductor and the return conductor (the trackway) and the other winding c^3 is in circuit with an adjacent section b and the return conductor.

In Figs. 1 and 2 the windings c^2 of one relay C^1 is connected with a section b, while the winding c^3 of another relay C^1 is in circuit with the same section. This is immaterial, for the reason that should the potential of that section drop for any reason, the armatures of the relays will move to open the operating circuit irrespective of the direction of movement of the armature. In Fig. 2, the potential of the middle section has dropped, by reason of excessive leakage, short circuit or any other cause, or raised above its normal potential for any cause, thereby producing more or less current in the windings of the relays with which it is connected than that existing in the other windings, thus producing a movement of the armatures relatively to the field to open the operating circuits of the indicators.

In Fig. 3 instead of having two windings of the same number of turns in a relay device, I provide one winding c^{10} to operate the indicator C, which winding is in circuit with a section of the feeder conductor and the return for the current of the section. Included in this circuit is a movable contact piece c^{12} operated by a winding c^{11}. The windings are so proportioned that both will operate at the same potential. The winding c^{11} is in circuit with an adjacent section b of the working conductor and the return for the current of the section. In this form of the invention should the potential of the middle section b fall materially below that of the adjacent sections, the windings in circuit with that section would be unable to hold the contact c^{11} in position to hold the circuit in which it is included closed, or the indicator in the position indicating that the potential of the conductor is about the same as the other sections of the feeder conductor, or as high as it should be.

It is obvious that other means could be utilized to indicate the difference of potential between the sections of a working conductor. One obvious means would be two volt meters or a differentially wound voltmeter. Such volt meters could control an audible or visible indicator, or the pointers of such meters may be the indicator.

What I claim as my invention is:

In combination with two sections of a working conductor of an electric railway, of an indicator for indicating the potential condition of the two sections, a circuit for said indicator, a relay for controlling said circuit comprising two windings, one being in circuit with one section and a return for the current in the section, and the other winding being in circuit with the other section and the return for the current in the section.

In testimony whereof I have signed my name to this specification in the presence of two subscribed witnesses.

LOUIS H. THULLEN.

Witnesses:
HENRY R. BAUER.
J. A. RENNIE.