No. 836,153. PATENTED NOV. 20, 1906.

L. H. THULLEN.

SIGNALING SYSTEM FOR ELECTRIC RAILWAYS.

APPLICATION FILED JUNE 9, 1906.

2 SHEETS—SHEET 1.

Fig. 1.

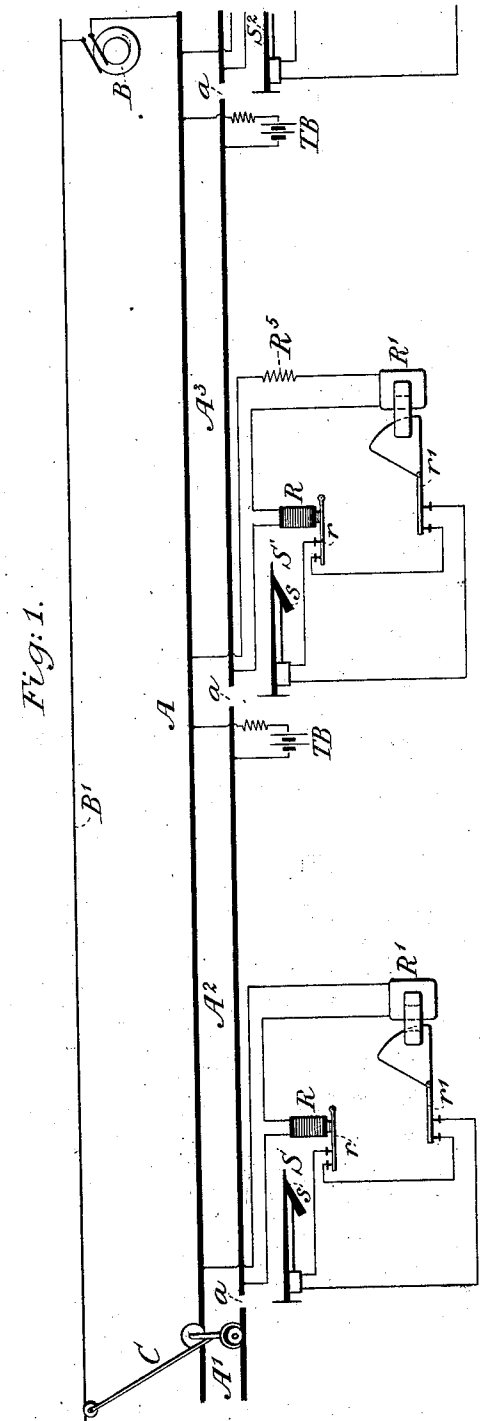
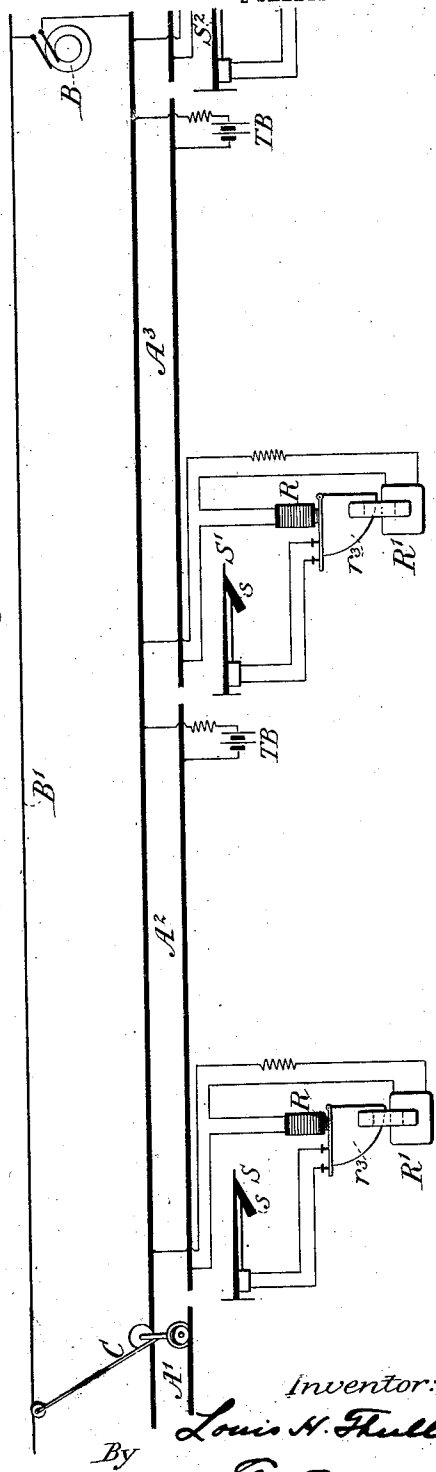


Fig. 2.



Witnesses:

J. A. Rennie

A. Herman Wegner.

Inventor:

Louis H. Thullen

By Fred. E. Crane

his Attorney.

No. 836,153. PATENTED NOV. 20, 1906.

L. H. THULLEN.

SIGNALING SYSTEM FOR ELECTRIC RAILWAYS.

APPLICATION FILED JUNE 9, 1906.

2 SHEETS—SHEET 2.

Fig. 3.

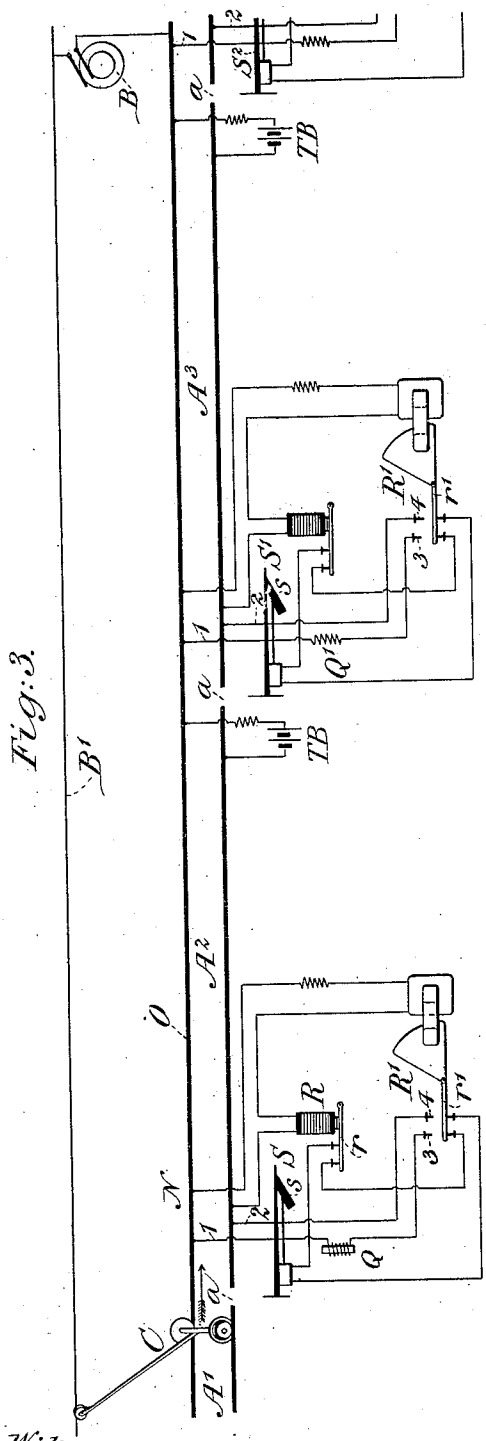
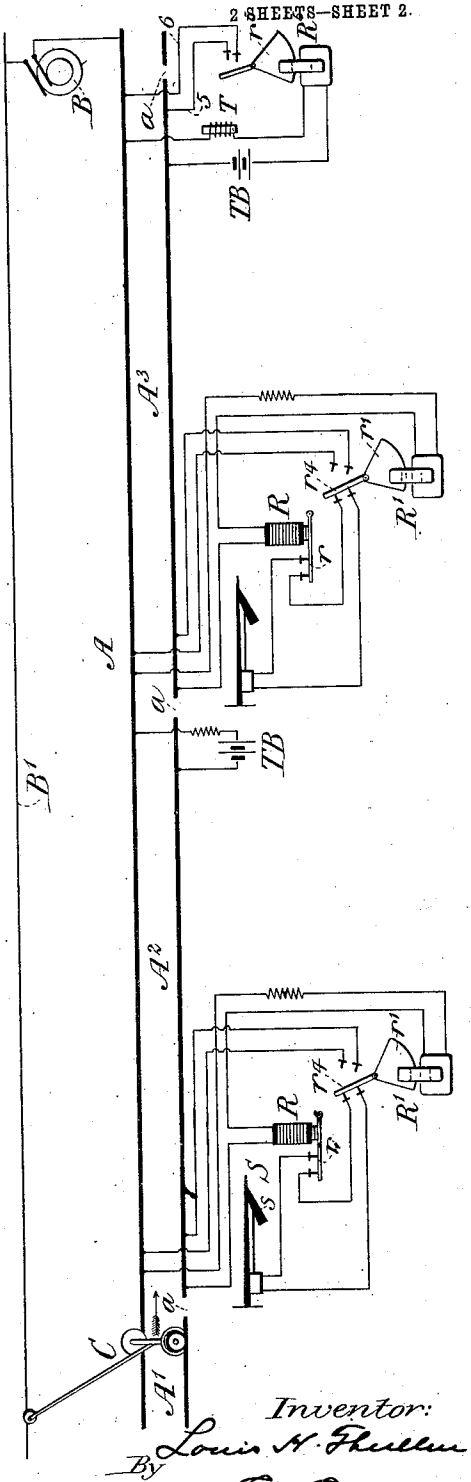


Fig. 4.



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

Inventor:
Louis H. Thullen
By Geo. E. Corner
his Attorney.

UNITED STATES PATENT OFFICE.

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

SIGNALING SYSTEM FOR ELECTRIC RAILWAYS.

No. 836,153. Specification of Letters Patent. Patented Nov. 20, 1906.

Application filed June 9, 1906. Serial No. 320,935.

To all whom it may concern:

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

My invention relates to signaling systems for electric railways, and especially for electric railways employing alternating current for the propulsion of motor-cars along the railway and the track as the return or part of the return conductor for the propulsion current.

I will describe a signaling system for such 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 an electric railway having applied thereto a signaling system embodying my invention. Fig. 2 is a view similar to Fig. 1, but illustrating a modification. Fig. 3 is a view similar to Figs. 1 and 2, but illustrating another form of my invention. Fig. 4 is a view similar to Fig. 3, but illustrating a modification of the form of invention illustrated in Fig. 3.

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

A designates a portion of an electric railway the trackway of which is shown as being divided to form block or track sections A′, A^2, A^3, &c. The division of the railway to form block-sections is here shown as being accomplished by inserting suitable insulation *a* at points in one or both of the two rails of the railway.

B designates a generator for supplying alternating current for propelling motor-cars along the railway. There may be a plurality of such generators located at different stations in a manner well understood in the art. One pole of each such alternating-current generator is connected with a trolley-wire or third rail B′, with which trolleys or shoes carried by the motor-cars make contact. The other pole of each such generator is connected with the rail or rails of the railway in a manner well understood in the art, so that such rail or rails may be used as part of the return conductor for the propulsion current.

The passage of cars or trains into and along the several block-sections is controlled or regulated by railway-signals, one such signal being located, preferably, at the entrance end of each block or track section.

S S′, &c., designate the railway-signals. Each railway-signal comprises a signal device *s*, preferably in the form of a semaphore, and an operating mechanism which is employed to move the signal device from one of its positions of indication (its horizontal position) to another of its positions of indication, (its inclined position.) This form of railway-signal and its operation is well known in the art and will not be further described. All the description of the operation of this type of railway-signal that is necessary to an understanding of this invention is that when no car or train is in a block or track section the signal device is held in its inclined position of indication by the operating mechanism and when a car or train is in a block or track section an electrically-operated device comprised in the operating mechanism is deprived of current, thus permitting the signal device to assume a horizontal or other position of indication, preferably under the influence of gravity, different from the first-mentioned inclined position. Each block or track section is provided with a closed track-circuit the relay of which controls the position of the signal device for that block-section. Of course in other types of signaling systems the relay of the track-circuit may be made to control one or more other signal devices. Each track-circuit comprises a source of direct current TB and a relay or plurality of relays.

Referring now to Fig. 1, each track-circuit comprises two independent relays R and R′. The relay R is of the ordinary type of direct-current relay usually employed in signaling systems, and the relay R′ is of a type which is responsive only to alternating current. Such a type of relay is illustrated in my copending application filed October 13, 1903, Serial No. 176,836.

As shown in Fig. 1, the coils comprised in the two relays are in series circuit with each other and with the two rails of the track or block section and the source of direct current. In series circuit with the coils of the relays R R′ is an inductive resistance R^5, which is for the purpose of limiting the amount of al-

ternating current flowing in the track-circuit. As is well known, these impedances R^5 are of low ohmic resistance, so as to permit of a free passage of direct current. The armature r of relay R and the armature r' of relay R′ control what is termed a "local" circuit, which local circuit includes an electromagnetic device comprised in the operating mechanism of the railway-signal. When the local circuit is closed, the said electromagnetic device is energized and the operating mechanism moves the signal device from its horizontal to its inclined position and retains the signal device in this position. When the said electromagnetic device is deënergized, due to the circuit including it being opened, the signal device returns to its horizontal position.

The armature r' of the relay R′ has a bias toward the contacts which it is adapted to close. When the coils of this relay are energized by an alternating current, the armature is moved away from the contacts. In this form of the invention the direct current from the source TB of a block or track section flows through the coil or coils of the relay R′ of its block-section; but this direct current will not cause a movement of the armature r'. Thus with no car or train in the block-section the direct current from the source TB only energizes the relay R, which attracts its armature against its contacts in the local circuit. When the direct current from the source TB is shunted from the relays R R′, the relay R will drop its armature and thus open the local circuit at that point. Should there be any appreciable flow of alternating current through the coils of the relays R R′ of a block-section—that is, sufficient alternating current to energize their coils, which may be the case when a car or train is in their block-section—the signal device will remain at "danger," owing to the relay R′ moving its armature r' to open the local circuit at that point.

Referring now to Fig. 2, the two relays R R′ operate a common armature r^3. If desired, the coils of the two relays R R′ may be combined so as to form a single relay. The operation of this form of the invention is the same as that described in connection with Fig. 1.

Referring now to Fig. 3, the same signaling system is employed as that illustrated in Fig. 1. In addition the relay R′ is employed to control a short circuit across the rails of the block-section, which short circuit is closed when there is an unnecessarily high or abnormal alternating-current potential across the rails of a block-section, due to an unusual resistance in the return path for the alternating propulsion current or to other causes. This short circuit, which is conductors 1 2, connected with the two rails of a block-section and with contacts 3 4, controlled by the armature r' of relay R′, is of a determined resistance, this being obtained by either a resistance Q′ or an impedance Q. The purpose of having this circuit of a determined resistance is to prevent a complete short circuit of the relay R′, so that it will not be deprived of current, and thus become inoperative to keep closed the short circuit. In order that the function of this short circuit may be understood, I will assume that the continuous rail of the track is interrupted at a point O in some manner which interferes with the flow of the return propulsion current along it and that a car or train C is at the point shown. It will be seen at once that an abnormal potential of alternating current between the two rails of block-section A^2 exists at the point N, which alternating-current potential would cause more alternating propulsion current to flow through the coils of the relays R R′ than was estimated upon or desirable. This being the case, the relay R′ would instantly respond and its armature would engage the contacts 3 4 to close the short circuit across the track-rails at this point, and thus prevent injury to the electrical apparatus connected with the track-rails of the railway. In the short circuit for block-section A′, I have shown an impedance Q′, while in the short circuit for the block-section A^2, I have shown a resistance Q.

In Fig. 4 the same signaling system is employed as that illustrated in Fig. 3, as is also the short circuit across the track-rails of a block-section which is closed when there is an unusual alternating-current potential across the track-rails of the block-section. The armature r' of relay R′ is weighted, as in Figs. 1 and 2, and normally rests against the contact or contacts of the local circuit which it controls. The armature r', however, is vertically arranged, so that when the part r^4 is moved past the vertical plane of its pivot by alternating current in the coils of the relay R′ it will drop against the contacts 3 4 of the local circuit and remain there until manually moved to its normal position.

In block-section A^3, I have also shown a relay R^5 at the battery end of the block-section, the coil or coils of which are in series circuit with the battery TB of that block-section and the track-rails. The armature r^5 of this relay controls a short circuit 5 6 across the track-rails of the block-section A^3, and this short circuit is closed should there be an unusual potential of alternating current adjacent the battery, thereby relieving the battery from the effects of the flow of the alternating propulsion current. The relay R^5 and the short circuit controlled thereby may be used in each block or track section.

In series circuit with each battery TB is an impedance T, the purpose of which is to limit at all times the amount of alternating current which would tend to flow through

the battery. These impedances are of low ohmic resistance to direct currents.

I do not limit myself to the use of two relays, as shown in Fig. 4, as it is obvious that one relay could be made to operate in the manner described having two windings and a common armature.

What I claim as my invention is—

1. In combination with an electric railway the trackway of which is divided to form block-sections and serves as part of the return-path for the car-propulsion current, of a source of alternating current for the cars, and a signaling system, said system comprising a railway-signal for each block-section, and a track-circuit for each block-section, which track-circuit includes a source of direct current and two relay-coils, one of which will move an armature in response to a flow of direct current and the other of which will move an armature in response only to a flow of alternating current.

2. In combination with an electric railway the trackway of which is divided to form block-sections and serves as part of the return-path for the car-propulsion current, of a source of alternating current for the cars, and a signaling system, said system comprising a railway-signal for each block-section, and a track-circuit for each block-section, which track-circuit includes a source of direct current and two relays, one of which is responsive to direct current and the other of which is responsive only to alternating currents.

3. In combination with an electric railway the trackway of which is divided to form block-sections and serves as part of the return-path for the car-propulsion current, of a source of alternating current for the cars, a signaling system for the railway which comprises a railway-signal for each block-section, a track-circuit for each block-section which includes a source of direct current, a relay-coil responsive to direct current and a relay-coil responsive to alternating current, and a short circuit across the track-rails of each block-section which is controlled by the relay-coil responsive to alternating currents.

4. In combination with an electric railway the trackway of which is divided to form block-sections and serves as part of the return-path for the car-propulsion current, of a source of alternating current for the cars, a signaling system for the railway which comprises a railway-signal for each block-section, a track-circuit for each block-section which includes a source of direct current, a relay-coil responsive to direct current and a relay-coil responsive to alternating current, and short circuits across the track-rails of each block-section which are controlled by relay-coils responsive to alternating currents.

5. In combination with an electric railway the trackway of which is divided to form block-sections and serves as part of the return for the car-propulsion current; of a source of alternating current for the cars, and a signaling system for the railway which comprises a railway-signal for each block-section and a track-circuit for each block-section, each track-circuit including a source of direct current, a relay-coil responsive to direct current to control the railway-signal, and a relay-coil responsive to alternating current to control the signal only when an abnormal alternating-current potential exists across the track-rails of a block-section.

6. In combination with an electric railway the trackway of which is divided to form block-sections and serves as part of the return-path for the car-propulsion current, a source of alternating current for the cars; a signaling system for the railway which comprises a railway-signal for each block-section, and a track-circuit for each block-section; each track-circuit including a source of direct current, a relay-coil responsive to the direct current, a relay-coil responsive to the alternating current, and a means operated by one of the coils for establishing a short circuit across the track-rails of a block-section.

7. In combination with an electric railway the trackway of which is divided to form block-sections and serves as part of the return-path for the car-propulsion current; a source of alternating current for the cars; and a signaling system for the railway which comprises a railway-signal for each block-section and a track-circuit for each block-section; each track-circuit including a source of direct current, two relay-coils one responsive to direct current and the other to alternating current, and a means operated by one of the coils for establishing and maintaining until released manually a short circuit across the track-rails of a block-section.

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

LOUIS H. THULLEN.

Witnesses:
J. B. STRUBLE,
W. L. MCDANIEL.