No. 823,648. PATENTED JUNE 19, 1906.

L. H. THULLEN.

RAILWAY SIGNALING.

APPLICATION FILED FEB. 5, 1904. RENEWED MAY 10, 1906.

3 SHEETS—SHEET 1.

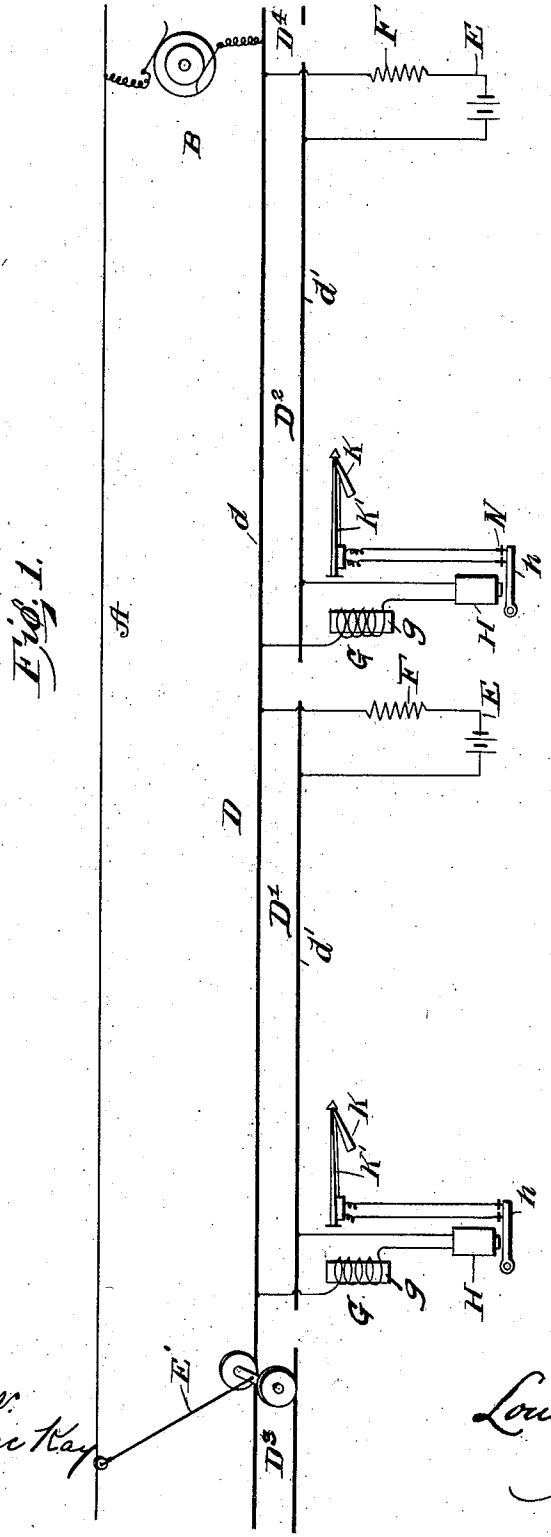

Fig. 1.

Witnesses:
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M. J. MacKay

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By Geo. B. Crane.
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3 SHEETS—SHEET 2.

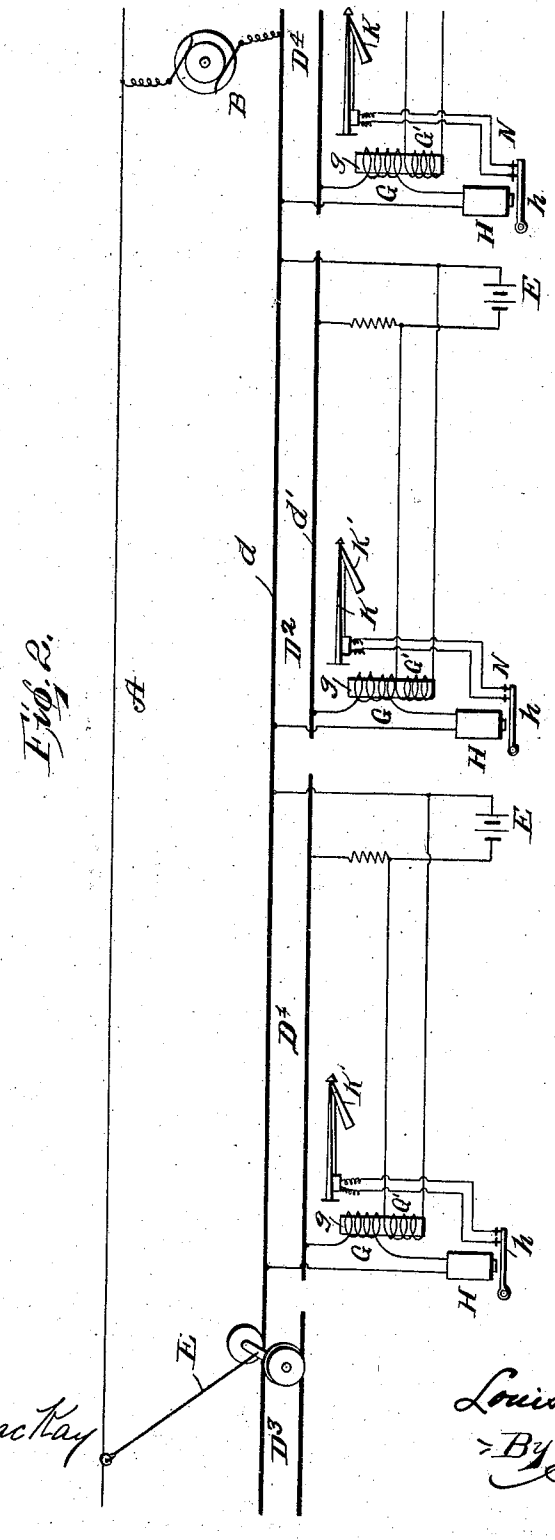

Fig. 2.

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3 SHEETS—SHEET 3.

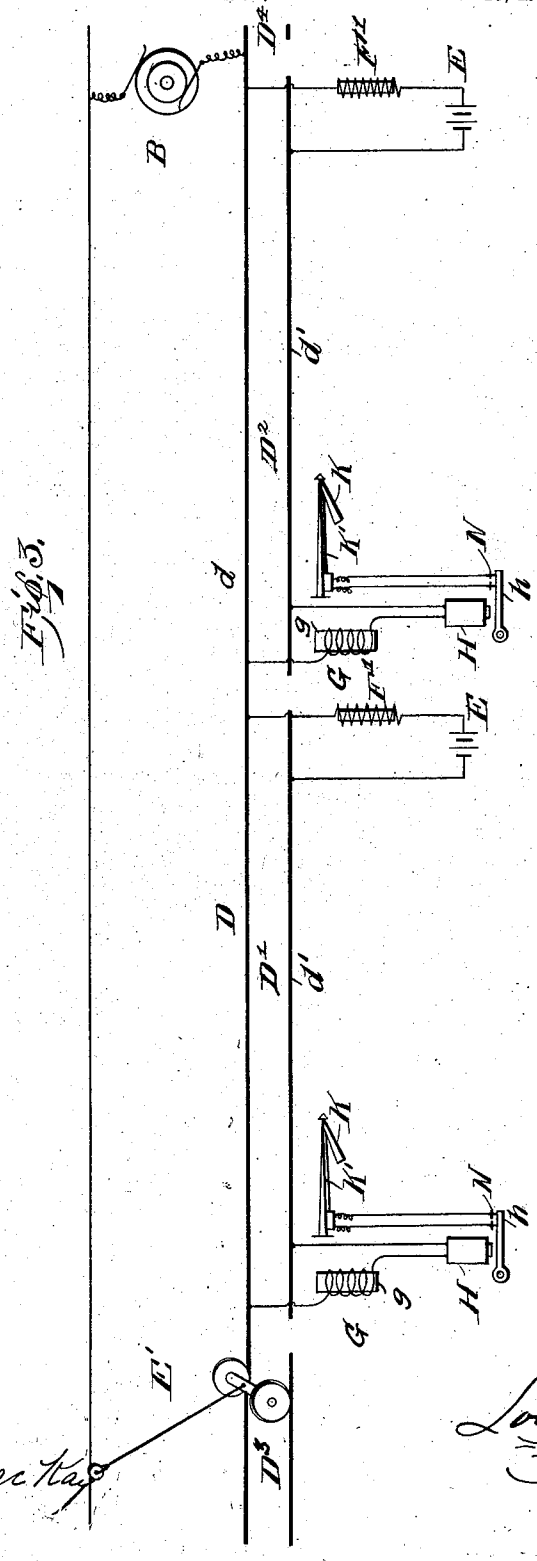

Fig. 3.

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UNITED STATES PATENT OFFICE.

LOUIS H. THULLEN, OF EDGEWOOD, PENNSYLVANIA.

RAILWAY SIGNALING.

No. 823,648. Specification of Letters Patent. Patented June 19, 1906.

Application filed February 5, 1904. Renewed May 10, 1906. Serial No. 316,090.

To all whom it may concern:

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

My invention relates to a signaling system, and is particularly adapted to railways over which electric cars are propelled, the motive power for the motors of which is alternating current and with a return for the propulsion-current through the rails or a rail.

I will describe a railway signaling system 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 my invention applied thereto. Fig. 2 is a view similar to Fig. 1, but showing a modification of my invention. Fig. 3 is a view similar to Figs. 1 and 2, but showing another modification of my invention.

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

D designates a railroad, one of the rails *d* of which is electrically continuous throughout its length, while the other rail *d'* is divided into sections, which sections are suitably insulated from one another. Preferably each insulated section will be of a length equal to what may be termed a "block-section." In the drawings I have shown two such sections D' D^2 and portions of two adjacent block-sections D^3 and D^4.

K' designates railway-signals, one being provided for each block-section. Each railway-signal preferably comprises a signal device K in the form of a semaphore and a suitable mechanism by which the semaphore K may be moved from one position of indication to another. The mechanism of each railway-signal may be any design; but it will preferably be electrically controlled.

Each block-section D, D', and D^2, &c., comprises a closed track-circuit, which closed track-circuit includes a source of electrical energy, a portion of both track-rails of the block-sections, and a translating device. In the present invention the source of electrical energy is preferably a battery E, which supplies direct current to the track-circuit. The translating device may be any design, and, as here shown, consists of an ordinary relay H, the armature *h* of which controls a local circuit, including contact-points N and the electrically-operated controlling mechanism of the railway-signal. It will be understood that if the continuity of the closed track-circuit is complete or the track-rails included in the circuit are not bridged by the wheels and axle of a car or cars the current will flow from the battery E to energize the translating device H, which closes the contact N, and thereby close the circuit of the electrically-operated device of the signal mechanism. Under the foregoing conditions the railway-semaphore will be in the "clear" or "safety" position of indication, and should any condition exist other than those heretofore stated the semaphore will be moved or will move to the "danger" position of indication.

A designates a conductor which is connected with one pole of alternating-current generator B, the other pole of which is connected with the continuous rail *d* of the railroad.

E' is a diagrammatical representation of an electric car provided with a trolley which is in contact with the conductor A, which may be either an overhead wire or a third rail. It will be seen that a circuit from the generator is supplied the motor in the car E' through the trolley, and the return for the propulsion-current will be particularly through the track-rail *d*, though paths are provided by which any propulsion-current in the insulated sections *d'* may reach the rail *d*, so that, in effect, the return will be through both of the track-rails.

In order that the propulsion-current may not affect the translating device H, I preferably include means in the closed track-circuit which will prevent a sufficient quantity of alternating current reaching the translating device, thereby causing it to be energized, especially at times when it should be deënergized. The means which I employ are preferably an inductive winding G. This winding may be in the form of an iron core with either a closed magnetic circuit or with an open magnetic circuit, or it may be used without a core. It will be understood that I do not limit myself to any particular form of inductive winding or to any particular means for excluding alternating current from the translating device, as it is within the scope of my invention to employ any means for excluding alternating current from the translating device. The object of this winding is

to eliminate as much as possible all alternating current traversing the track-circuit from reaching the translating device. The inductive winding being of low ohmic resistance offers very little resistance for the passage of direct current to the translating device.

F designates a resistance included in the closed track-circuit for the purpose of limiting the amount of current flowing through the battery E when the two rails included in the track-circuit are short-circuited.

Referring now to Fig. 2, the inductive winding G is provided with a second or differential winding G', which embraces the core *g* of the inductive winding. The inductive winding G' is in multiple circuit with the battery E. The purpose of this differential winding G' is to neutralize the magnetic action of the direct current on the iron core of the inductive winding. The direct current passing through the inductive winding G has a tendency to magnetize the core to a considerable extent, thereby causing higher magnetic saturation of this core. The higher the saturation of the core the greater amount of alternating current there will be traversing this inductive winding, which, as hereinbefore stated, counteracts the magnetization of this core by the direct current, thereby keeping down the alternating current which might traverse this coil the lowest possible amount.

In Fig. 3 instead of the resistance F, I employ an inductive resistance F', the purpose of which is to prevent alternating current in the track-circuit for traversing the battery of that track-circuit.

It will be understood that both the track-rails can be used for the return of the propulsion-current, and wherever in the claims I have used the word "rail" I do not wish to be understood as being limited to only one rail.

What I claim for my invention is—

1. In a signaling system for use on electric railways employing alternating current as motive power and a rail for the return thereof, the combination of a series of block-sections, a closed track-circuit for each block-section which includes a portion of both track-rails, a source of direct current for each track-circuit, a translating device included in each track-circuit, and an inductive winding included in the track-circuit for preventing alternating current effectively operating the translating device.

2. In a signaling system for use on electric railways employing alternating current as motive power and a rail for the return thereof, the combination of a series of block-sections, a closed track-circuit for each block-section which includes a portion of both track-rails, a source of direct current for each track-circuit, a translating device included in each track-circuit, an inductive winding included in the track-circuit for preventing alternating current effectively operating the translating device, and means for counteracting the magnetization of the core of the inductive winding caused by the direct current in the track-circuit.

3. In a signaling system for use on electric railways employing alternating current as a motive power and a rail for the return thereof, the combination of a series of block-sections, a closed track-circuit for each block-section which includes a portion of both track-rails, a source of direct current for each track-circuit, a translating device included in each track-circuit, a resistance included in the track-circuit between the battery and the rails, and means also in each track-circuit for preventing alternating current effectively operating the device.

4. In the signaling system for use on electric railways employing alternating current as motive power, and the rail for the return thereof, the combination of a series of block-sections, a closed track-circuit for each block-section including a portion of both track-rails, a source of direct current for each track-circuit, a translating device included in each track-circuit, an inductive winding included in the track-circuit for preventing alternating current effectively operating the translating device, and a second winding on the core of the inductive winding, which second winding is included in multiple with the direct-current supply for counteracting the magnetization of the core of the inductive winding caused by the direct current in the track-circuit.

5. A signaling system for railways the trackway of which is employed as a return for alternating propulsion-current, a source of alternating propulsion-current, a series of track-circuits formed in part by the trackway, a source of direct current for each track-circuit, a relay for each track, and an impedance-coil in each track-circuit.

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

LOUIS H. THULLEN.

Witnesses:
W. L. McDANIEL,
GEORGE McCORMICK.