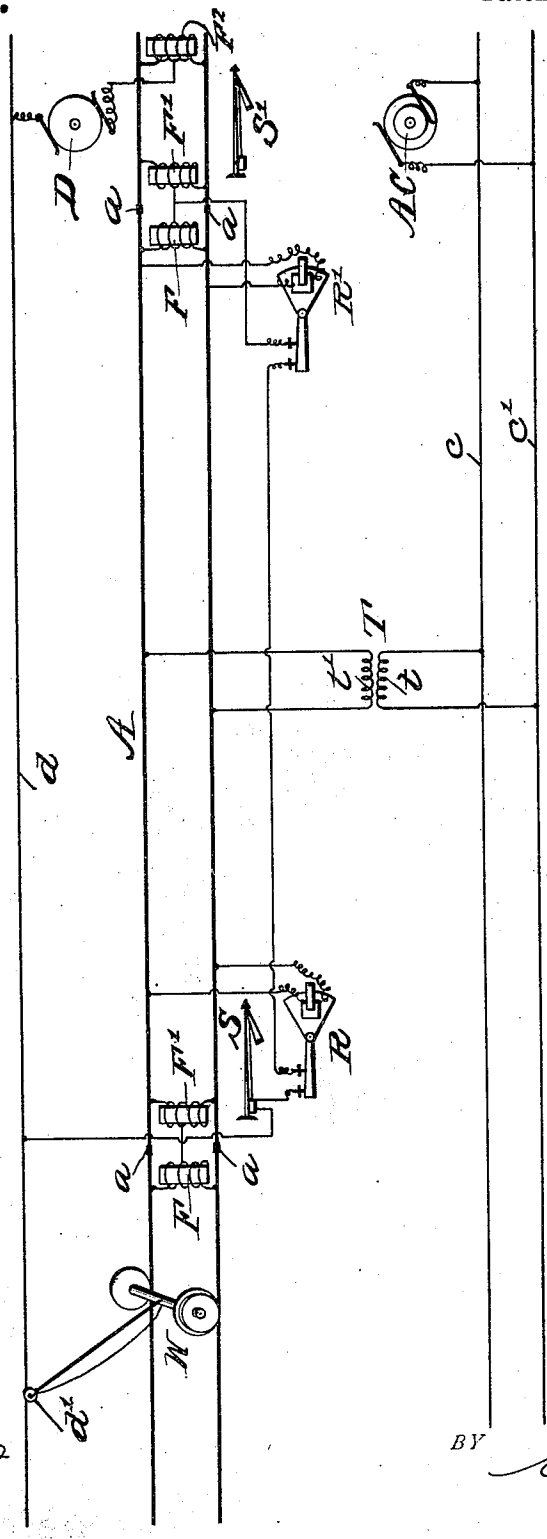
L. H. THULLEN.

SIGNALING SYSTEM FOR RAILWAYS.

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1,109,880. **Patented Sept. 8, 1914.**



WITNESSES:

L. C. Wilson.

J. B. Robb

INVENTOR.

Louis H. Thullen

BY

Geo. E. Crouse

HIS ATTORNEY.

UNITED STATES PATENT OFFICE.

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

SIGNALING SYSTEM FOR RAILWAYS.

1,109,880. Specification of Letters Patent. Patented Sept. 8, 1914.

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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 Railways, of which the following is a specification.

My invention relates to signaling systems for railways, and it is particularly adapted for use in connection with electric railways wherein the track rails are employed as a return path for the propulsion current used for the car or vehicle motors. I will describe a signaling system embodying my invention and its application to an electric railway and then point out the novel features thereof in claims.

The accompanying drawing is a diagrammatic representation of a portion of a railway and a signaling system embodying my invention.

Referring now to the drawing, A designates a portion of a railway having its opposite lines of rails provided with insulation *a* at suitable points to form what are technically known in the art as "track" or "block sections."

D designates a generator for supplying through a line conductor *d* propulsion current for the motors carried by cars or vehicles traveling along the railway. The generator D may be a direct current generator or an alternating current generator. Each car or vehicle carrying a motor is provided with a trolley d^1 or other equivalent device which contacts with the conductor *d* as the car or vehicles travel along the railway. The return for the propulsion current from the motors is through the track rails and to permit of this and thus save the cost of line conductors or cables for this purpose, I provide inductive windings F, F^1, at each insulation point along the railway. These inductive windings and their arrangement are set forth in my application for patents filed February 5th, 1904, Serial Nos. 192,145 and 192,146. It is sufficient to here state that the windings be so constructed and arranged that the propulsion current of any description will freely pass through them without appreciably affecting them in any way, while the alternating current for track circuit purposes will be impeded and confined in its effect to the separate track or block sections. With this arrangement I am enabled to use both track rails for the return of the propulsion current. One pole of the generator D is connected to the winding of an inductive cross bond F^2, while the other pole is connected with the line conductor *d*.

The passage of cars or vehicles along a track section, as I shall hereafter call them, is controlled by railway signals. The railway signals may be of any desired type, that is, automatic or semi-automatic, each of which type comprises an electrically operated or controlled device which is controlled from the track circuit of the track section. In the drawings I have shown two railway signals S, S^1, each of which comprises a semaphore or other signal device and an automatically operated mechanism of any well-known type. Each track section is provided with a track circuit which, as usual, comprises a source of current, the opposite or portions of the opposite lines of rails and translating devices each in the form of a relay which controls a local circuit. The source of current for each track circuit may be any desired and as here shown is in the form of a transformer T to be hereinafter referred to. The primary winding *t* of each transformer is in circuit with mains *c*, c^1, extending along the railway from an alternating signaling current generator A. C., while its secondary t^1 is connected with the track rails of its track section. The translating device or relays R and R^1 may be of any desired construction provided it is responsive to the current intended for its operation. Preferably each translating device will be substantially of the form shown and described in my application for patent filed October 13th, 1903, Serial No. 176,836. The "local circuit" or other circuit which is controlled by the translating device includes a source of current and the electrically operated or an electrically controlled device of the railway signal. The source of current for the local circuit may be any desired, and as here shown is obtained from the direct current generator D. In the event that alternating current is used for propelling the cars, the alternating signaling current will be of a different frequency.

Heretofore in signaling systems and espe-

cially in block signaling systems, it is usual to place the source of signaling current at one end of the track section, usually at the exit end, and the translating device or relay at the other or entrance end. In the present invention I preferably employ two translating devices R, R¹, for each track section and locate them preferably at or near the ends of the track section and the source of signaling current supply for the track circuit between the ends of the track sections preferably at a point midway of the ends of the track section. The object in locating the source of current, in this instance the transformer T, between the translating devices R, R¹, is as follows: In all track circuits it is desirable that the amount of current and the E. M. F. thereof be kept as low as possible on account of the leakage from the track rails and for other reasons economical and otherwise. Especially is this true of alternating current, for, as is well known, the track rails offer considerable impedance to an alternating current which varies from 1 to an infinite number of times the ohmic resistance, depending upon the frequency of the current. At ordinary frequency (from 25 to 133 cycles) this impedance might approximately be 20 times the ohmic resistance. Therefore by placing the supply of alternating current at one end of a track section and the translating device at the other end thereof, a comparatively high E. M. F. of alternating current is required at the source of current to supply the necessary E. M. F. to operate the translating device. For example, if the transformer is at one end of a track section and the translating device at the other end; the A. C. potential at the transformer end will be from 6 to 12 times greater than the A. C. potential at the other, and therefore, there is a likelihood of the insulating joints breaking down between two adjacent track sections, and the transformer furnishing current to the translating device in the adjacent track section. To overcome this and other objections I locate the source of alternating signaling current (in this case the transformer T) at a point between the translating devices, preferably at a point midway of the ends of the track section. With this arrangement the high alternating E. M. F. or potential is at substantially the middle of the track section and substantially the same alternating current E. M. F. is obtained at the terminals of both translating devices and at the ends of the track section. With this arrangement of the transformer a much lower E. M. F. of alternating current could be used in the track circuit which is highly desirable, or the length of the track section could be double at the same A. C. potential as used when the transformer is at one end of the block.

What I claim as my invention is:

1. In a signaling system for electric railways in which the track rails are employed as a return path for the propulsion current, the combination with a series of insulated track sections, inductive windings connecting the rails of adjacent track sections, a track circuit for each track section, translating devices for each track circuit, one such translating device being located at about each end of the track circuit, and a source of alternating current for each track circuit located at about the middle of each track section.

2. In a signaling system for electric railways in which the track rails are employed as a return path for the propulsion current, the combination with a series of insulated track sections, of inductive windings arranged to be unaffected by the passage of the propulsion current from one track section to another but to afford a path of high impedance to the passage of alternating signaling current, and a track circuit for each track section which comprises a source of alternating signaling current located between the ends of the track section and adapted to deliver an alternating signaling current at the ends of the track section of lower potential than at its point of connection with the track rails of the track section.

3. The combination in a signaling system for electric railways, the track rails of which are used as a return for the propulsion current, and are divided into insulated sections, of inductive windings for connecting the track rails of adjacent track sections, a track circuit for each track section which comprises at least two translating devices one being located at about one end of the track circuit and the other located at about the other end of the track circuit and a source of alternating current, said source of alternating current being located at a point in the track circuit whereby substantially equal alternating current potentials will be supplied the track rails of the track section at the terminals of each inductive winding at the ends of the track section.

4. The combination in a signaling system for electric railways, the track rails of which are used as a return for the propulsion current and are divided into insulated track sections, an inductive winding at each track section which permits of the passage of the propulsion current, and a track circuit for each track section comprising at least two relays one being located at about one end of the track circuit and the other located at about the other end of the track circuit and a source of alternating current located in the track section at a point to produce a higher alternating current potential between the track rails than that produced at the inductive windings at the ends of the track section.

5. The combination in a signaling system for electric railways, the track rails of which are used as a return for the propulsion current and are divided into insulated track sections, inductive windings at each track section which afford a path of high impedance, and a track circuit comprising at least two relays one being located at about one end of the track section and the other located at about the other end of the track section and a source of alternating current located in the track section at a point to produce a higher alternating current potential between the track rails than that produced at the inductive windings at the ends of the track section.

6. In combination with a railway, the track rails of which are divided by insulation into track sections and form a part of the return path for the car propulsion current, a pair of inductive windings placed at each insulation point, one winding being connected with the track rails of one track section and the other winding being connected with the track rails at the adjacent track section, and the middle points of adjacent windings being electrically connected, and a track circuit for each track section, each track section comprising a relay device to control a railway signal and a source of signaling current located at about the middle point of the track circuit.

7. In combination with a railway the track rails of which are divided by insulation into track sections and form a part of the return path for the car propulsion current, a pair of inductive windings placed at each insulation point, one winding being connected with the track rails of one track section and the other winding being connected with the track rails of the adjacent track section, and the middle points of adjacent windings being electrically connected, and a track circuit for each track section comprising a source of alternating signaling current located at a point in the track section to produce a higher alternating current potential between the track rails than that produced at the inductive windings at the ends of the track section.

8. In a signaling system for electric railways, the combination with a source of power current, a transmission system therefor of which both track rails form a part, a plurality of track sections, means for conducting the propulsion current from the track rails of one track section to an adjacent track section, a source of signaling current for each block section located at about the middle point of the block section, a railway signal for each block section, a controlling means for said railway signal energized from the track, the energy being taken from the track at one portion of the block section, and a second controlling means for said railway signal energized from the track, the energy being taken from another portion of the block section.

9. In a signaling system for electric railways, the combination with a source of power current, a transmission system therefor of which both track rails form a part, a plurality of track sections, means for conducting the propulsion current from the track rails of one track section to an adjacent track section, a source of signaling current for each block section, located at about the middle point of the block section, a railway signal for each block section, a controlling means for said railway signal at one end of a block section, a controlling means for the railway signal at the other end of the same block section, and both of said controlling means energized from the track by the signaling current of the block section.

10. The combination in a signaling system for railways, of track circuits formed in part by the track rails of the railway, a source of alternating signaling current connected across the track rails and located about the middle of the track circuit, two translating devices for each track circuit and completing said track circuit, one translating device being located at one end of the track circuit and the other translating device being located at the other end of the track circuit, and railway signals, one railway signal being provided for each track circuit and controlled by both translating devices of its track circuit.

11. In combination with an electric railway, a source of power current; vehicles operated thereby; a circuit for said power current, comprising two conductors with which the vehicles make moving contact, one of which is formed by the track; signal circuits of which the rails of the track form two sides; a plurality of signal devices for each signal circuit; and a source of alternating signaling current for each signal circuit connected across the track-rails and located intermediate the two signal devices.

12. In combination with an electric railway; a source of power current; vehicles operated thereby; a circuit for said power current comprising two conductors with which the vehicles make moving contact, one of which is formed by the track; signal circuits of which the rails of the track form two sides; signal devices for each signal circuit one such signal device being located at about each end of the track circuit; a source of alternating signaling current for each signal circuit connected across the track-rails and located at about the middle of each signal circuit, and means for limiting the alternating signaling currents to the several signal circuits.

13. In combination with an electric railway, a source of power current; vehicles op-

erated thereby; a circuit for said power current comprising two conductors with which the vehicles make moving contacts, one of which is formed by the track; signal circuits of which the rails of the track form two sides; signal devices for each signal circuit one such signal device being located at about each end of the track circuit, a source of alternating signaling current for each signal circuit connected across the track-rails and located at about the middle of each signal circuit, and cross-bonds located at about the ends of the signal circuits.

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

LOUIS H THULLEN.

Witnesses.
GEO. E. CRUSE,
A. HERMAN WEGNER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."