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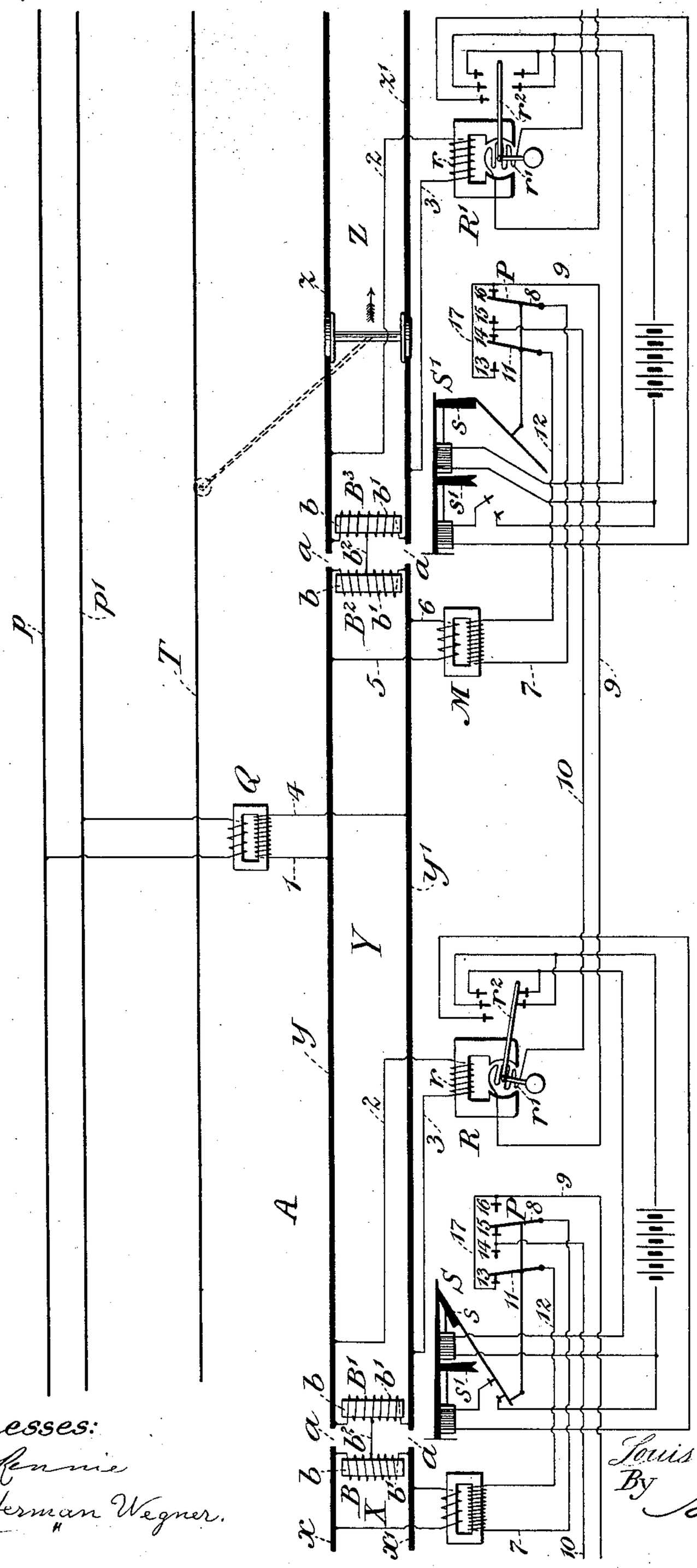
L. H. THULLEN.

SIGNALING SYSTEM FOR RAILWAYS.

APPLICATION FILED MAY 28, 1906.



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UNITED STATES PATENT OFFICE.

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SIGNALING SYSTEM FOR RAILWAYS.

No. 868,302. Specification of Letters Patent. Patented Oct. 15, 1907.

Application filed May 28, 1906. Serial No. 319,009.

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 especially to railways, the track rails of which are included in and form part of the return path or conductor to the generator for the current employed for propelling motor cars along the railway.

I will describe a signaling system embodying my invention and then point out the novel features thereof in claims.

The accompanying drawing is a diagrammatical representation of a portion of an electric railway, the track rails of which are divided by insulation to form block or track sections and are used as part of the return path or conductor to the generator of propulsion current, and a signaling system applied thereto and embodying my invention.

Similar reference characters designate corresponding parts on the drawing.

I have illustrated my invention in connection with one railway track on which cars or trains travel in one direction only. On double track roads the signaling system is duplicated, due regard being had in regard to economical installation, such as the reduction of the number of wires, some wires being used in common.

My invention is also applicable to railroads on which cars or trains travel in both directions.

Referring now to the drawing, A designates a portion of a railway which is divided into sections X, Y, Z, etc. These sections are generally termed "block or track sections" and I will hereinafter refer to them as block sections. These block sections are formed by inserting insulation *a* in some form at determined points in one or both of the traffic rails, one arrangement being the equivalent of the other and both being well known in the art. In the drawing I have shown insulation *a* inserted in both of the traffic rails.

x, x^1, designate the track rails of block section X, y, y^1, the track rails of block section Y, and so on.

A generator of current for propelling the cars, (one or more and not shown), which may be either an A. C. generator or a D. C. generator, is provided.

T designates a trolley or third rail connected with one pole of the power generator and extending along the railway in a usual and well known manner. As the track rails of the railway, one or both, are to form part of the return path or conductor for the propulsion current employed for the motor cars and still contain insulation to form block sections, I make provision for conducting such current from the rails of one block section to the adjacent, around the points of insulation. This I accomplish by means of inductive bonds, located at the insulated points which inductive bonds comprise a core and a winding or windings surrounding the core, the inductive bonds being of such construction and arrangement as to afford a path of low ohmic resistance for the propulsion current, from the rails of one block section to the rails of another block section.

A form of bond which I preferably employ is described and illustrated in my co-pending application filed February 27, 1906, Serial No. 303,155, and which is diagrammatically illustrated in my applications filed February 5th, 1904, Serial Nos. 192,145 and 192,146. These inductive bonds generally stated, each comprise a laminated iron core which may or may not have an open magnetic circuit and a winding of few turns. The ends of the winding are connected with the two rails of the block section, while a conductor extends from the middle of the winding and which conductor is arranged to be connected to the middle point of the winding on an adjacent bond. In the drawing I have diagrammatically illustrated the bonds and their connections.

B, B^1, B^2, B^3, etc. designate the bonds. *b* designates the core thereof which may have either a closed or open magnetic circuit, depending upon conditions, and a winding b^1 surrounding a leg of the core. Instead of one winding b^1 there may be two windings each of the same number of ampere turns on the same leg, electrically joined together at adjacent ends to form in effect one winding. In such case the point at which they are electrically joined is the middle point of the winding.

b^2 designates a conductor joining the middle points of two adjacent coils. This conductor as will be seen, may be common to two adjacent coils. The rails, of course, will be connected to the generator in the usual and well known manner understood in this art. Thus it will be seen that the current taken from the feed conductor T and after passing through the car motors to the rails will flow through the rails and winding of the bonds back to the generator A. It will be seen that the propulsion current in its passage through the windings of the bonds flows in at their ends and out at its middle point or in at its middle point and out at its ends in reverse or opposite directions, the result being that the core is not appreciably magnetized, so that the bond may be used as a path of impedance for alternating signaling currents which may be used in the track circuits. This has been all set forth in my applications hereinbefore referred to, Serial No. 192,145 and 192,146.

The foregoing, it will be seen, is directed more particularly to the arrangement of the track in the return path or conductor of power circuit whereby the propulsion current flows along it, although it is divided into insulated sections to form the block or track sections of the signaling system.

My present invention relates to a signaling system for a railway of the type herein described, though my invention may be used on railways the track rails of which are not used as conductors for propulsion current, as for example, steam railways. I have illustrated what is known in the art as a "home and distant" signaling system, a home and a distant signal being located at the same point, on the same post or support and one above the other.

S, S^1, etc. designate railway signals, each comprising a "home" semaphore signal and a "distant" semaphore signal. Such railway signals are diagrammatically illustrated. A type of railway signal which may be employed is that illustrated in U. S. Patent No. 611,943, granted October 4, 1898, to J. G. Schreuder. As is well understood in such signaling systems, the home semaphore and distant semaphore must at times give different indications. For example, a train entering and proceeding along block section Y, will, when it enters the block section, automatically cause the home and distant semaphores of railway signal S to move to their horizontal or danger position. So long as the car or train or any portion of it remains in block section Y the semaphores of railway signal S will remain in their horizontal or danger position. When the car or train enters block section Z, it will automatically cause the home and distant semaphores of railway signal S^1 to move to their horizontal or danger positions. After the car or train has passed out of block section Y, the home semaphore of railway signal S is moved to an inclined or its safety position while the distant semaphore is maintained in its horizontal position. After the car or train has moved out of block section Z into the next and succeeding block section, the distant semaphore of railway signal S is moved to its inclined position. Of course, the car or train on entering the block section succeeding Z will automatically cause the home and distant semaphore of the railway signal for that block section to move to their horizontal positions, and after the home semaphore of railway signal S^1, after the car or train has left block section Z will be moved to its inclined position while the distant semaphore will remain in its horizontal position. Thus it will be seen that a train entering one block section automatically causes the home and distant semaphores of the railway signal located at the entrance end of the block section to move to their positions; the train after leaving that block section and entering the next succeeding or second block section permits of the home semaphore being moved to its inclined position; and after leaving the said next or second block section and entering the next succeeding or a third block section permits of the distant semaphore of the first mentioned block section being moved to its inclined position. The foregoing movements of the several semaphores of the railway signals occur in order as the train moves into and out of the several block sections.

The movements of the semaphores are controlled automatically through the action of the car or train on signaling circuits formed in part by the track rail, a signaling circuit being provided for each block section. A car or train entering a block section shunts or short circuits the source of current of the signaling circuit for that block section from the translating device or relay so that the relay as I shall hereinafter term it, will act to open a local circuit or circuits of a railway signal and permit the semaphores to move to their horizontal positions. When a train moves out of that block section and into the next, it shunts or short circuits the source of current of the signaling circuit for that block section from the relay, as it did in the other block section and permits the semaphores for the said next block section to move to their horizontal position. The home semaphore of the next or second block in moving to its horizontal position actuates a "pole changing device" to effect a change in the direction of flow of signaling current in a part of the relay circuit, which change in direction of flow affects the relay of that signaling circuit to have it operate in a certain manner. The preferred arrangement, is that when no car or train is in a block section the relay of that block section closes the local circuits on the operating mechanism of the home and distant semaphores, the signaling current of the signaling circuit energizes the armature and field coils of the relay to produce lines of force so as to produce a turning movement of the armature in one direction relatively to the coil; when a car or train is in the block section the signaling current of the signaling circuit of that block section is shunted or short-circuited and the relay is deënergized, in which case the armature of the relay moves or is moved to such position as to open both local circuits of the home and distant semaphore; when the car or train moves out of that block section and into the next, the flow of current in the armature coil, or it may be the field coil, of the relay of the relay section just vacated by the car or train flows in a reverse direction, thereby producing a reverse movement of the armature relatively to the field to close only the local circuit of the home semaphore. The reversal in direction of flow of the current is preferably accomplished by what is termed in the art as a "pole changing device" which is mechanically connected with the home semaphore of a railway signal.

I preferably employ an alternating current in each signaling circuit, and in the event that alternating current is used for propulsion purposes the A. C. of the track circuit may be of a different frequency or phase or both from the phase and frequency of the propulsion current or when A. C. is used for propulsion purposes I may use direct current in the signaling circuits. In any event, the relay or translating device is constructed to respond only to control its signal to the signaling current. A generator for alternating signaling current (not shown) is provided.

p, p^1, designate conductors extending therefrom along the line of railway.

Q, designates a step-down transformer, one being provided for each block section. These transformers are for supplying alternating signaling current to the track circuits of the block sections, and preferably the transformer for each block section will be located at about the middle point of the signaling circuit of the block section, so that it will supply alternating signaling current to both ends of the signaling circuit.

R, R^1, etc. designate translating devices or, as I shall hereinafter term them, "relays." Each relay as shown, comprises a field coil r embracing a field and an armature coil r^1. The field coil is energized by current from one end of the signaling circuit and the armature coil from the other end of the track circuit and

preferably through a step-up transforming device, here shown as a transformer and designated M, and through a pole changing device P.

Each relay R, R^1, is of a type which requires current in both its armature and field coils simultaneously to produce a turning movement of the armature relatively to the field. When the direction of flow of current is reversed in either of the coils there is a reverse movement of the armature relatively to the field. This type of device is well known in the art. The armature coil of each relay carries an arm r^2 which is movable between front and back contacts. Preferably the three front contacts are included in the local circuits of both the home and distant semaphores, and the two back contacts are included only in the local circuit of the home semaphore. The arrangement of these local circuits are well understood and may be arranged in any desired manner. It will be seen, therefore, that the relay, when the arm r^2 is against its front contacts the local circuits of the home and distant semaphores are closed, when moved against its back contacts only the local circuit of the home semaphore is closed, and when not on either its front and back contacts both local circuits are open.

A signaling circuit may be traced as follows, taking as an example the signaling circuit of the block section Y: Starting from one terminal of the secondary of the transformer Q, one half of the signaling circuit is wire 1, track rail y, wire 2, field coil r of relay R, wire 3, track rail y^1, and wire 4 to the other terminal of the transformer. The other half of the signaling circuit from the secondary of the transformer, is wire 1, track rail y, wire 5, primary of step-up transformer M, wire 6 to track rail y^1 and wire 4. The secondary winding of the transformer M includes the armature coil r^1, and the circuit may be traced as follows: From one terminal of the winding it is wire 7, an arm 8 of a "pole changing device" P, wire 9, coil r^1, wire 10, a second arm 11 of the "pole changing device" P, and wire 12 to other terminal of secondary winding. The arms 8, 11, of the "pole changing device" P work between contacts 13, 14, 15 and 16, the contacts 13 and 16 being joined by a wire 17. The "pole changing devices" P, or as they are some times called "pole changers", are well understood in the art and I will not, therefore, specifically describe any particular construction. Their function is to reverse the direction of flow of a current. In the present invention they are employed to reverse the flow of direction of the alternating signaling current in the coils r^1 of the relays R, R^1, etc. It is obvious that the armature coil can be connected directly with the track rails instead of the field coil. In this event the direction of flow of current will be reversed in the field coil through the pole changing device.

The operation of my invention is as follows: With no car or train in any block section the home and distant semaphores s, s^1 of the various railway signals will be in their inclined positions of indication, and the arms r^2 of each of the relays will be against their front contacts, thus keeping closed the local circuits. The pole changers P of each block section will be in the position occupied by the pole changer P of block section Y. Assume now that a car or train has passed from block section Y to block section Z. In entering block section Y both semaphores of railway signal S were moved to their horizontal positions of indication, due to the wheels and axles of the car or train acting as a shunt or short circuit for the transformer Q. (This condition is illustrated in block section Z.) As the car or train entered block section Z, both semaphores of railway signal S^1 were moved to their horizontal positions, and as the car or train moves out of block section Y, current from transformer Q of block section Y will again act to energize the coils r, r^1 of relay R, but as the position of the pole changer P of block section Z has been changed, the direction of the flow of current in the coil r^1 of relay R will be changed so that it will flow in the opposite or reverse direction and hence produce a reverse turning movement of the coil r^1 of relay R. This reverse movement of the coil r^1 throws its arm r^2 onto its back contacts and only closes the local circuit on the home semaphore. As soon as the train leaves block section Z, the home semaphore s of railway signal S^1 will be moved to its inclined position (for the reasons set forth in connection with home semaphore s of railway signal S) and in doing so the pole changer is again operated to again change the direction of flow of current in the coil r^1 of relay R. This last change in direction of flow of current causes the coil r^1 of relay R to move to throw its arm r^2 against its front contacts and thus close both local circuits of the semaphores of railway signal S. As the car or train moves along the railway through the successive block sections the devices of the system operate in the manner hereinbefore described. It will be seen, therefore, that the direction of flow of signaling current in the track rails is always the same, but that the direction of flow of current in one of the coils of the relay is changed.

What I claim as my invention is:

1. In a railway signaling system, the combination of a series of block sections, a home and distant semaphore and operating mechanism located at the entrance end of each block section, and a signaling circuit for each block section including a source of alternating signaling current located at about the middle of the signaling circuit and a relay which comprises a field coil and an armature coil, the armature of said relay controlling the positions of the home and distant signals of its block section.

2. In a railway signaling system, the combination of a series of block sections, a home and distant semaphore and operating mechanism located at the entrance end of each block section, a signaling circuit for each block section including a source of alternating signaling current located at about the middle point of the signaling circuit and a relay which controls the positions of said semaphores, said relay comprising a field coil and an armature coil, and means operated by the movement of a home semaphore to reverse the direction of flow of current in one of the coils of the relay.

3. In a railway signaling system, the combination of a series of block sections, a home and distant semaphore and operating mechanism located at the entrance end of each block section, a signaling circuit for each block section including a source of signaling current located at about the middle of the block section and a relay which controls the positions of said semaphores, said relay comprising a field coil and an armature coil both of which coils are energized from the current in the signaling circuit for controlling the positions of the home and distant semaphores of its block section, and means for reversing the direction of flow of current in one of the coils.

4. In a railway signaling system, the combination of a series of block sections, a home and distant semaphore and operating mechanism located at the entrance end of each block section, a signaling circuit for each block section including a source of alternating signaling current located at about the middle point of the signaling circuit,

and a relay which controls the positions of said semaphores, said relay comprising a field coil and an armature coil, said coils being energized from the current in the signaling circuit, and means operated from a home semaphore for controlling the direction of flow through one of the coils of the relay.

5. In combination with a railway the rails of which are employed as a return for the propulsion current for the motor cars traveling along the railway, a signaling system for said railway having in combination a series of block sections, a home and distant semaphore and operating mechanism located at the entrance end of each block section and a signaling circuit for each block section, including a source of alternating signaling current located at about the middle point of the signaling circuit, and a relay comprising a field coil and an armature coil, said relay controlling the positions of the home and distant signals of its block section.

6. In combination with a railway the rails of which are employed as a return for the propulsion current for the motor cars traveling along the railway, a signaling system for said railway having in combination a series of block sections, a home and distant semaphore and operating mechanism located at the entrance end of each block section, a signaling circuit for each block section including a source of alternating signaling current located at about the middle point of the signaling circuit, and a relay which controls the positions of said semaphores, said relay comprising a field coil and an armature coil, said coils being energized from the current in the signaling circuit, and means operated from a home semaphore for controlling the direction of flow through one of the coils of the relay.

7. In combination with a railway the rails of which are employed as a return for the propulsion current for the motor cars traveling along the railway, a signaling system for said railway having in combination a series of block sections, a home and distant semaphore and operating mechanism located at the entrance end of each block section, a signaling circuit for each block section including a source of alternating signaling current located at about the middle point of the signaling circuit, and a relay which controls the positions of said semaphores, said relay comprising a field coil and an armature coil, said coils being energized from the current in the signaling circuit, and means operated from a home semaphore for controlling the direction of flow through one of the coils of the relay by reversing the current taken from one end of the signaling circuit.

8. In combination with a railway, the rails of which are employed as a return for the propulsion current for the motor car traveling along the railway, a signaling system for said railway having in combination a series of block sections, a home and distant semaphore and operating mechanism located at the entrance of each block section, a signal circuit for each block including a source of alternating current located about the middle point of the signaling circuit, and a relay operated by energy taken from both ends of the block section and a means for utilizing the wires traversed by the current that traverses one member of the relay to operate the distant signal.

9. In combination with a railway, the rails of which are employed as a return for the propulsion current for the motor car traveling along the railway, a signaling system for said railway having in combination a series of block sections, a home and distant semaphore and operating mechanism located at the entrance of each block section, a signal circuit for each block including a source of alternating current located about the middle point of the signaling circuit, and a relay operated by energy taken from both ends of the block section and a means for utilizing the wires traversed by the current that traverses one member of the relay to operate the distant signal, by reversing the direction of flow through said wires.

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

LOUIS H. THULLEN.

Witnesses:

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