L. V. LEWIS & J. S. HOLLIDAY.

RAILWAY SIGNALING SYSTEM.

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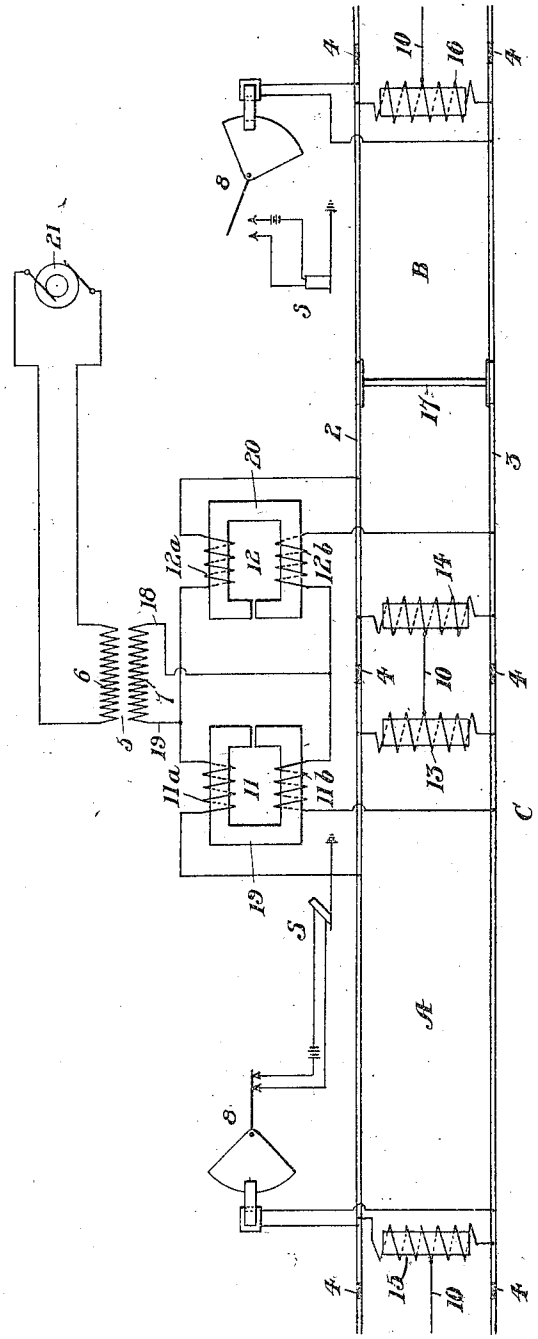
1,016,922. Patented Feb. 6, 1912.



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RAILWAY SIGNALING SYSTEM.

1,016,922. Specification of Letters Patent. Patented Feb. 6, 1912.

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To all whom it may concern:

Be it known that we, LLOYD V. LEWIS and JOHN S. HOLLIDAY, citizens of the United States, residing, respectively, at Edgewood and Wilkinsburg, 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.

Our invention relates to apparatus for use with alternating current signaling systems for electric railways both of the lines of track rails of which are included in the path for the propulsion current. More particularly, it relates to apparatus for use with such systems when the track circuits of two adjacent block sections are fed with alternating signaling current from the same transformer secondary.

The accompanying drawing is a diagrammatic view showing a portion of an electric railway having applied thereto a signaling system embodying our invention.

Referring to this drawing, C designates a portion of an electric railway the track rails of which are divided by insulations 4 to form block sections A, B, etc. It is understood that both of the lines of track rails are included in the circuit for the propulsion current, hence means must be provided for conducting the propulsion current around the insulations 4. As here shown, this means comprises inductive bonds 13, 14, 15 and 16, which bonds are preferably of the type shown and described in United States Letters Patent No. 838,916, granted to L. H. Thullen on Dec. 18, 1906. Briefly described, each of these bonds comprises a soft iron core upon which are wound several turns of an electric conductor. The ends of the windings of the bonds are connected with the two opposite track rails adjacent the ends of the block sections, and the middle point of the winding of each bond is connected with the middle point of the winding of the adjacent bond by means of a conductor 10. It will be evident that the propulsion current in its passage through the winding of each bond flows in at the ends and out at the middle point, or in at the middle point and out at the ends, and that therefore if the flow of propulsion current is equal in the two lines of rails, the iron core of the bond will not be magnetized by this current. Hence the bond will not be inductive to the propulsion current when the propulsion current is alternating. But since the alternating signaling current, hereinafter explained, tends to flow through the winding of each bond from end to end, the bonds will be inductive to this current and therefore impede the flow of signaling current from one line of rails to the other.

We have not shown the generator for the propulsion current nor the remainder of the circuit for the propulsion current; these elements are so well understood as to require no further illustration or description.

Each block section is provided with a track circuit comprising as usual the track rails (or portions of them) of the block section, a source of signaling current, and a relay. As here shown, the source of current for two adjacent block sections, for example block sections A and B, is a transformer 5 whose primary 6 is connected with a source of alternating signaling current 21, and whose secondary 7 is connected with the track rails of both block sections A and B. The alternating signaling current may be of any desired frequency when the propulsion current is direct, but when the propulsion current is alternating, the frequencies of the propulsion and signaling currents are preferably different.

8, 8, designate relays for the block sections A and B respectively, which relays may be of any desired type which will respond to the signaling current and not to the propulsion current in their normal or usual control of their signals.

S, S, designate railway signals, controlled by relays 8, 8, in a usual and well known manner.

Included in each track circuit between the secondary of the transformer and the track rails is a resistance, which may be either inductive or non-inductive. In the accompanying drawing, 11 is the resistance for the track circuit of block section A, and 12 is the resistance for the track circuit of block section B. These resistances may be employed to limit the discharge of signaling current from the transformer secondary when the track rails of a block section are occupied by a car or train, or they may be

employed to affect the phase of the signaling current supplied to the relay by the track circuit, or they may be employed for both of these purposes or for other purposes.

As shown in the accompanying drawing, the resistance 11 (non-inductive or inductive) in the track circuit of block section A is divided into two substantially equal portions 11^a and 11^b, one of which portions is included in each of the two leads between the transformer secondary and the track rails. Similarly, the resistance 12 for the track circuit of block section B is divided into two substantially equal portions 12^a and 12^b, one of which is included in each of the leads between the transformer secondary and the track rails. With this arrangement, there will be no flow of current between the middle points of bonds 13 and 14, even when the total resistances 11 and 12 are unequal, for the reason that these middle points will always have the same potential, and this potential will be the same as that of the middle point of the transformer secondary 7. This is evident, from the fact that the circuit between each terminal of the transformer secondary and the middle point of each of the bonds includes a half winding of the bond and a half of the total resistance 11 or 12. With a car 17 in block section B as indicated in the drawing, although the bond 14 will be shunted by the car, the potential of the middle point of this bond will still be equal to that of the middle point of the secondary 7 for the reason that there are equal resistances 12^a and 12^b between the terminals of the secondary 7 and the middle point of bond 14. Hence the two track circuits will be entirely free from interference with each other, regardless of whether or not one or the other or both are occupied by a car, except for such slight action as may occur within the windings of the transformer.

It is often advantageous that the resistances 11 and 12 should be inductive. When such is the case, the two portions 11^a and 11^b are preferably in the form of two coils wound on one magnetic core 19, and the two portions 12^a and 12^b are preferably in the form of two coils on another magnetic core 20, as illustrated diagrammatically in the drawing. With this construction, the total impedance of either pair of coils 11 or 12 may be varied by varying the reluctance of the common magnetic circuit for each pair, the impedance of the two coils on each core being always equal. The coils are connected with the track rails and with the source of signaling current in such manners that the magnetic flux induced in each core by signaling current flowing in the two coils wound thereon will be all in the same direction, so that the coils are inductive to the signaling current; but that the magnetic flux induced by propulsion current in the two coils will be in opposite directions and will therefore be neutralized, so that the core will not be magnetized by the propulsion current, and so that when the propulsion current is alternating its flow will not be impeded by the windings. This arrangement of the coils will be readily understood by reference to the accompanying drawing.

When the coils 11^a, 11^b, 12^a and 12^b are connected as just described, they will automatically compensate for conditions caused by "unbalanced" propulsion current in the two lines of rails. When unbalancing occurs, that is, when more propulsion current flows in one line of rails of a block section than in the other line of rails, there will be more propulsion current in one half of the winding of the bonds 13, 14, 15 and 16 than in the other half, and consequently the cores of the bonds will become magnetized. This magnetization will lower the impedance of the bond to the signaling current, allowing more signaling current to flow through the bond and thereby having a tendency to reduce the voltage of the signaling current at the relay. But at such times, the flow of propulsion current in the two coils on each core 19 and 20 will also be unbalanced, and the propulsion current will magnetize these cores, thereby reducing their impedance to the signaling current and increasing the voltage of the signaling current impressed on the track rails. The voltage of the signaling current at the relays will thus be maintained substantially constant in spite of unbalancing of the propulsion current.

Having thus described our invention, what we claim is:

1. In a railway signaling system, two adjacent block sections, a source of alternating signaling current, a transformer whose primary is connected with the source of alternating signaling current and whose secondary is connected across the track rails of both block sections, and two substantially equal resistances connected respectively between the transformer secondary and each rail of one of the block sections.

2. In a railway signaling system, two adjacent block sections, a source of alternating signaling current, a transformer whose primary is connected with the source of alternating signaling current and whose secondary is connected across the track rails of both block sections, and two substantially equal resistances connected respectively between the transformer secondary and each rail of one of the block sections, and two substantially equal resistances connected respectively between the transformer secondary and each rail of the other block section.

3. In a signaling system for electric railways the track rails of which are included

in the circuit for the propulsion current, two adjacent block sections divided by insulation in the track rails, means for permitting propulsion current to flow from the rails of either of the said block sections to the rails of the other block section, a source of alternating signaling current, a transformer whose primary is connected with the source of signaling current and whose secondary is connected across the track rails of both of said block sections, two substantially equal resistances connected respectively between the transformer secondary and each rail of one of the block sections, and two substantially equal resistances connected respectively between the transformer secondary and each rail of the other block section.

4. In a signaling system for electric railways the track rails of which are included in the circuit for the propulsion current, two adjacent block sections divided by insulation in the track rails, means for permitting propulsion current to flow from the rails of either of the said block sections to the rails of the other block section, a track circuit for each block section each of which track circuits includes the opposite lines of rails of the block section, a source of alternating signaling current, a transformer whose primary is connected with the source of signaling current and whose secondary is connected across the track rails of both of said block sections, two substantially equal resistances connected respectively between the transformer secondary and each rail of one of the block sections, and two substantially equal resistances connected respectively between the transformer secondary and each rail of the other block section.

5. In a signaling system for electric railways, the track rails of which are included in the circuit for the propulsion current, two adjacent block sections divided by insulations in the track rails, means for permitting the propulsion current to flow from the rails of either block section to the rails of the other block section, a source of alternating signaling current, a transformer having its primary connected with the source of signaling current and its secondary connected across the track rails of both block sections, two substantially equal inductive resistances wound in the same direction on one magnetic core and interposed respectively between the secondary and each track rail of one of the block sections, and two substantially equal inductive resistances wound in the same direction on another magnetic core and interposed respectively between the secondary and each track rail of the other block section.

6. In a signaling system for electric railways the track rails of which are included in the circuit for the propulsion current, two adjacent block sections divided by insulation in the track rails, means for permitting the propulsion current to flow from the rails of one block section to the rails of the other block section, said means comprising an inductive winding connected across the opposite rails of each block section, and a conductor connecting the middle points of the said windings, a source of alternating signaling current, a transformer whose primary is connected with the source of signaling current and whose secondary is connected across the track rails of both block sections, two substantially equal resistances interposed between the secondary and each track rail respectively of one of said block sections, and two substantially equal resistances interposed between the secondary and each track rail respectively of the other block section.

7. In a signaling system for electric railways the track rails of which are included in the circuit for the propulsion current, two adjacent block sections divided by insulation in the track rails, means for permitting the propulsion current to flow from the rails of one block section to the rails of the other block section, said means comprising an inductive winding connected across the opposite rails of each block section and a conductor connecting the middle points of the said windings, a source of alternating signaling current, a transformer whose primary is connected with the source of signaling current and whose secondary is connected across the track rails of both block sections, two substantially equal inductive resistances wound in the same direction on one magnetic core and interposed respectively between the secondary and each track rail of one of the block sections, and two substantially equal inductive resistances wound in the same direction on another magnetic core and interposed respectively between the secondary and each track rail of the other block section.

In testimony whereof we affix our signatures in presence of two witnesses.

LLOYD V. LEWIS.
JOHN S. HOLLIDAY

Witnesses:
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C. R. BEALL.