No. 884,158. PATENTED APR. 7, 1908.

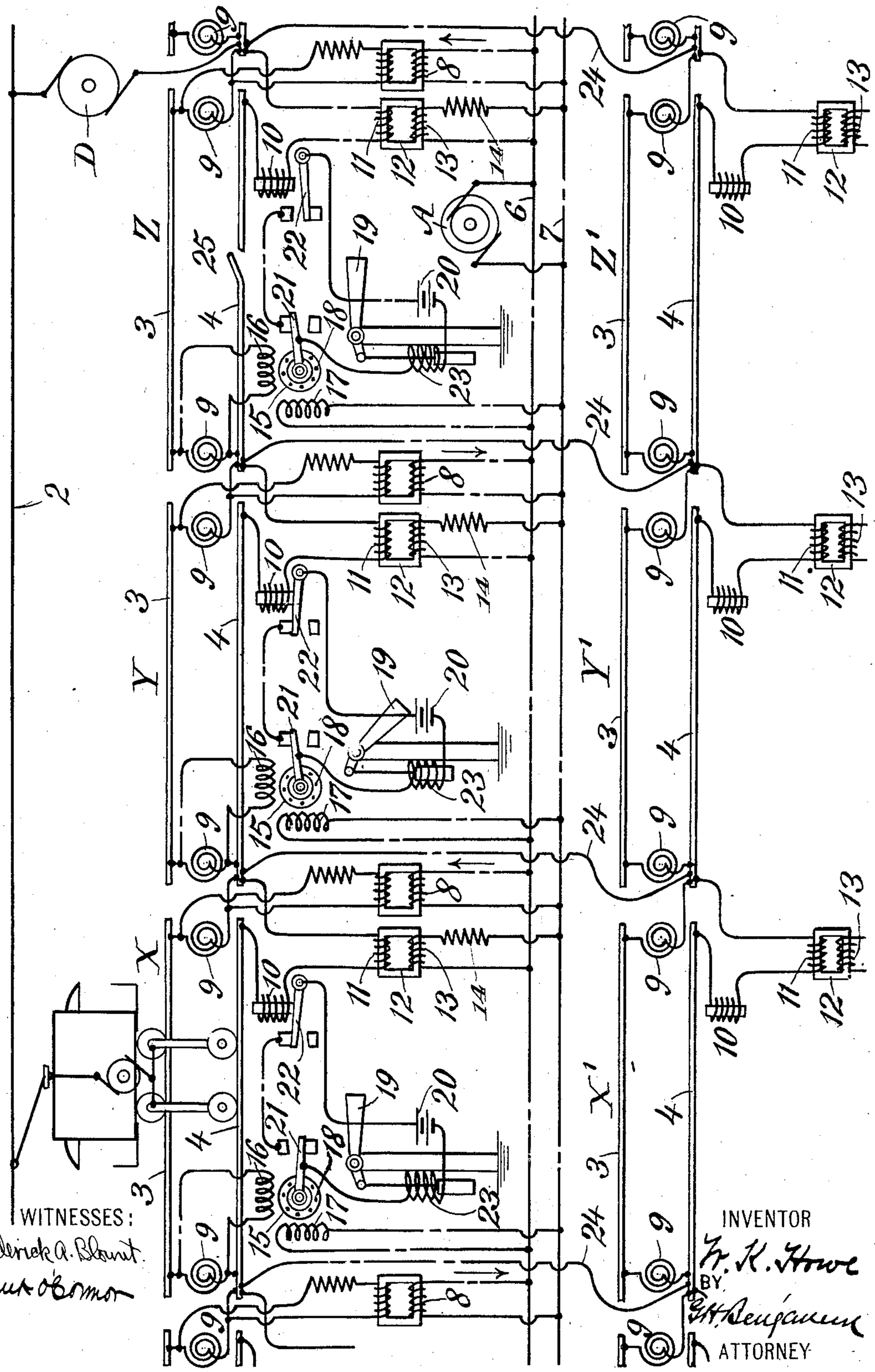
W. K. HOWE.

SYSTEM OF AUTOMATIC BLOCK SIGNALING FOR ELECTRIC RAILWAYS.

APPLICATION FILED SEPT. 28, 1906.

2 SHEETS—SHEET 1.

FIG. 1.



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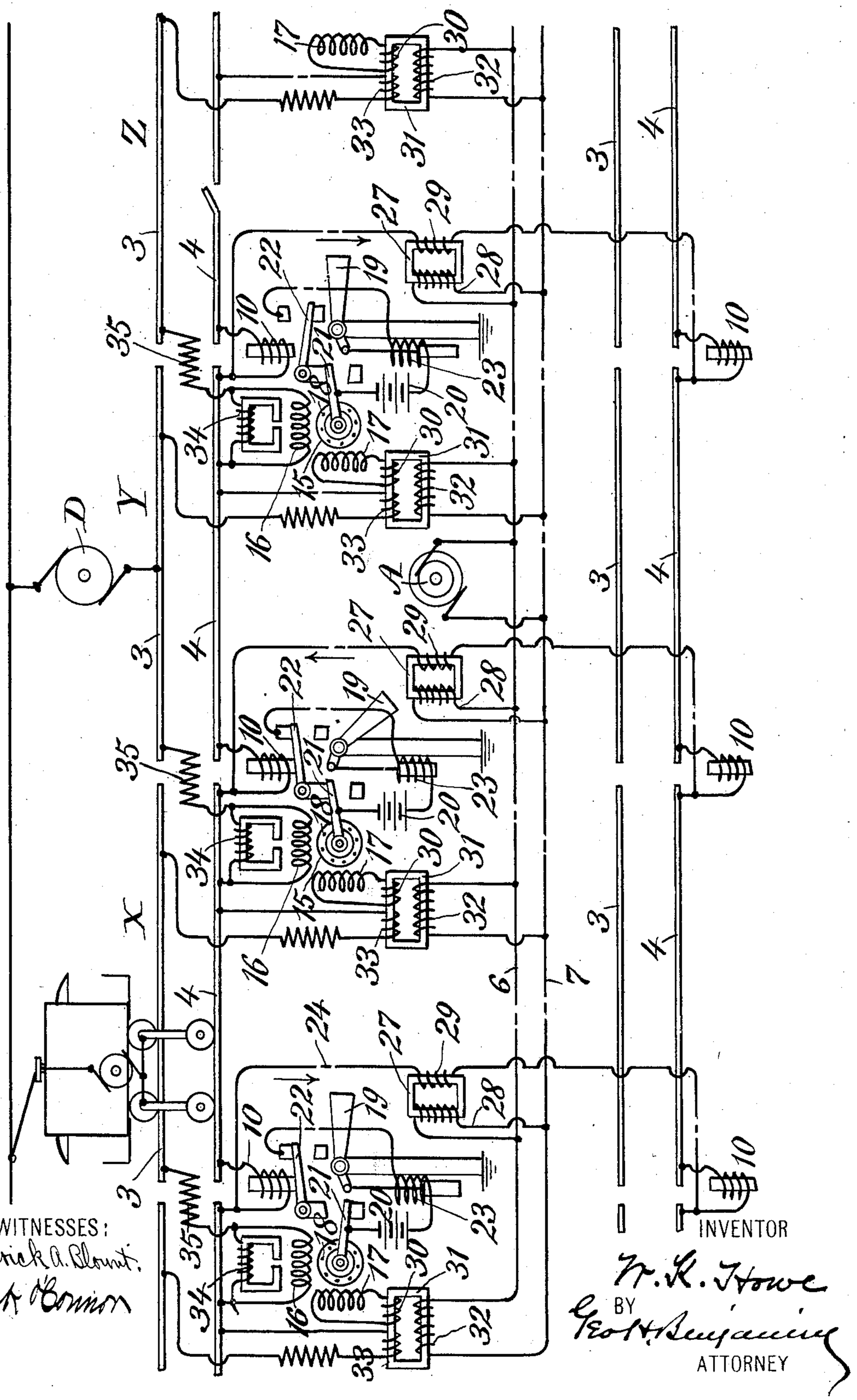
2 SHEETS—SHEET 2.

FIG. 2.



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UNITED STATES PATENT OFFICE.

WINTHROP K. HOWE, OF BUFFALO, NEW YORK, ASSIGNOR TO GENERAL RAILWAY SIGNAL COMPANY, A CORPORATION OF NEW YORK.

SYSTEM OF AUTOMATIC BLOCK-SIGNALING FOR ELECTRIC RAILWAYS.

No. 884,158. Specification of Letters Patent. Patented April 7, 1908.

Application filed September 28, 1906. Serial No. 336,612.

To all whom it may concern:

Be it known that I, WINTHROP KEITH HOWE, a citizen of the United States, residing at Buffalo, county of Erie, State of New York, have invented a System of Automatic Block-Signaling for Electric Railways, of which the following is a specification.

My invention consists in new and useful improvements in systems of automatic block signaling for electric railways.

In the general practice of block signaling, the signals indicate to an approaching train the condition of the block ahead, both as to the presence of another train in such block and as to the continuity of the traffic rails. In the application of block signaling to electric railways in which cross bonding between tracks is a feature, it is sometimes convenient to employ two currents for signaling purposes or two portions of the same current. One of such currents flows down one rail and up the other, its purpose being to indicate the location of the cars, and the other current flows along both rails in the same direction, which I will call a continuity current, and is employed to indicate any break or discontinuity in a rail of the track.

My invention relates to means for supplying this continuity current to the trackway and to the devices actuated by such current to give the required indications.

In the practice of my invention, the continuity current is supplied to the trackway where desired, by means of transformers, whose primaries are excited from the source of signaling current, and whose secondaries are in series with the path in the propulsion current. Relays are likewise connected in series within the path of the propulsion current. These relays are responsive both to the signaling current and to the propulsion current of the railway.

Figure 1 is a diagram illustrating the application of my invention to an electric railway of the two-rail type, in which the traffic rails both act as returns for the propulsion current back to the generator. Two tracks are shown, but the signaling devices are only complete in the case of the block sections X, Y, Z, of one track. The two tracks are cross-bonded. Fig. 2 is a diagram showing the application of my system to an electric railway of the one-rail type, in which a single continuous rail of each track carries the propulsion current back to the generator.

Referring to Fig. 1, D is the propulsion current generator, which is shown as a direct current machine and connected to an outgoing feeder conductor 2. 3, 4, are the traffic rails divided into block sections X, Y, Z, by insulated joints. A is an alternator supplying currents for signaling to the distributing mains 6 and 7. Transformers 8 supply signaling current derived from these mains 6 and 7 to the block sections X, Y, Z. Said block sections are rendered continuous as to the propulsion current, which is direct, and segregated as to the signaling current, which is alternating, by the reactance bonds 9, which tie the two traffic rails together at the end of each block section, the rail 4 being electrically continuous from one block section to the next through the windings of relay 10 and the secondaries 11 of transformers 12. Each transformer, 12, has its primary 13 connected across the mains 6 and 7 in series with the resistance 14. 15 is the track relay comprising two stator coils 16, 17, and a movable member 18. The signal 19 is operated by current derived from the battery 20, which normally flows through the contact 21 of relay 15, and the contact 22 of relay 10, and through the solenoid 23, which normally holds signal 19 in the "clear" position. The relay 10 may be designed, so that it will become saturated by the propulsion current, for in such a case, it is obvious that the flux produced will be sufficient to hold the contact 22 closed. Similarly, the transformer 12 may be designed so that it will begin to saturate for the same value of the propulsion current, as that which unaided would maintain the contact 22 of the relay 10 closed. The corresponding traffic rails of the two trackways, X, Y, Z, and X′, Y′, Z′, are connected together by the cross-bonds 24. 25 represents a break, or electrical discontinuity in one of the traffic rails. In the operation of this form of my invention, it will be seen that transformer 8 supplies current to a block section, which flows for instance down rail 3 and up rail 4. Such current backing up against the reactance of the coils 9 at the left-hand end of the block section, produces a difference of potential across the terminals of the coil 16, and as there is a

difference of phase between the currents in the coils 16 and 17, a turning moment of the movable member 18 of the relay 15 will be developed, normally closing the contact 21 in the absence of a car on the block section, as in sections Y and Z. The relay 10 will also remain closed, if there is no break in the rail 4, the contact 22 being held closed by such current as flows through the rail 4, either the propulsion current or the signaling current, or both, from the transformers 8 and 12. The function of the transformer 12 is to supplement the current supplied from the transformer 8. It will be seen that the secondaries 11 of the transformers 12 are reversed in polarity in adjacent block sections, their primaries 13 being connected in the reversed manner across the mains 6 and 7. The path of the currents in the cross-bonds, due to the transformers 12, will, therefore, be as indicated by the arrows shown on conductors 24. If the rail 4 is broken, as at 25 of section Z, even in the absence of a car on the block section, both the propulsion current and the signaling current will be interrupted in the relay 10, thus opening the contact 22 and allowing the signal 19 to go to the "danger" position. It will be seen that the secondaries 11 of transformers 12 do not produce a difference of potential across the traffic rails, and, therefore, will not indicate the location of the electric vehicles, but simply the continuity of the traffic rail 4. If the traffic rail 3 were to become interrupted, the current from transformer 8 flowing through the coil 16 of the relay 15, would be reduced to zero, thus deënergizing the relay 15 and opening the contact 21, so as to send the signal 19 to the "danger" position. When a car 26 enters the block section (block section X) the current from transformer 8 will be short-circuited upon itself and diverted from the coil 16, thus deënergizing relay 15, opening contact 21 and sending the signal 19 to the "danger" position.

In Fig. 2, the continuity current for rail 4 is supplied by a transformer 27, whose primary 28, is connected across the signaling mains 6 and 7, and whose secondary 29, is inserted directly in the cross-bonding conductor 24. The relay 10 is connected in series with the traffic rail 4, as in Fig. 1. The winding 17 of the relay 15 is energized from a secondary 30 of a transformer 31, whose primary 32 is connected across the mains 6 and 7. The said transformer has another secondary 33, which supplies the track circuit signaling current to the block section, as in Fig. 1, said current being designed to normally actuate the relay 15, by producing a rotary field through the joint action of the currents of coils 16 and 17. The coil 16 is connected across a reactance 34, which reactance is connected in series with a resistance 35 across the traffic rails, 3, 4, of a block section. The reactance 34 is designed not to saturate, by such small amount of propulsion current, as due to leakage or other causes is allowed to flow through it by the limiting resistance 35. It will be seen that the connections of the primaries 28 of transformers 27 of adjacent block sections are reversed so that the polarity of these secondaries 29 will be different in adjacent block sections. The paths of the currents in the cross-bonds will, therefore, be shown by the arrows. It will be seen that substantially the same flow of continuity current occurs in the arrangement of Fig. 2, as that of Fig. 1, and the operation of the system is substantially the same.

In carrying out my invention, it will be evident that the continuity current may be supplied in a considerable number of ways without departing from the spirit of my invention, and I desire it to be understood that I am the first to supply the continuity current locally to the traffic rails of an electric railway by means of transformers or other transmitting devices, or by any suitable means. Furthermore, my invention is applicable to a great variety of types of railway and to various arrangements of reactance bonds and signaling circuits.

Having thus described my invention, I claim:

1. A signaling system comprising an alternating generator, separate means connected therewith arranged to produce respectively a difference of potential across the rails and a continuity current along the rails of a block section.

2. A signaling system comprising a single alternating generator, separate means connected therewith arranged to produce respectively a difference of potential between the rails, and to send a continuity current through the rails, a relay connected with the rails to indicate the condition of the block as to occupancy, and a relay arranged to indicate the condition of the rails as to continuity.

3. A signaling system comprising an alternating generator, and means connected therewith arranged to create continuity currents in adjacent trackways.

4. A signaling system comprising a signaling current arranged to control a track circuit and means in each block for applying a local continuity current.

5. A signaling system comprising means in each block for separately indicating the presence of a break in either track rail.

6. A signaling system comprising a transformer connected across the track rails and a transformer connected in series with a track rail of each section.

7. A signaling system comprising means whereby the traffic rails of each block si-

multaneously transmit the whole propulsion current, and two signaling currents.

8. A signaling system comprising a relay in each block section traversed by the signaling current, and a relay traversed by the whole propulsion current and the signaling currents.

9. A signaling system comprising means for impressing a signaling current upon each block section, and means for causing a continuity current to flow locally upon the block sections.

10. In a signaling system the combination of a transformer and a relay both traversed by a propulsion current and adapted to be saturated by approximately the same value of propulsion current.

11. A signaling system comprising traffic rails divided into block sections, both of said traffic rails conducting the propulsion current freely, one of such traffic rails comprising in its circuit reactance bonds, and the other of such traffic rails comprising in its circuit relay devices and transformers.

12. A signaling system comprising a course of power current, a trackway divided into block sections, reactance bonds interposed between the block sections, means for exciting a difference of potential between the rails of each block section, means for locally exciting a continuity current along the rails of block sections, a relay controlled by such difference of potential, a relay controlled by said continuity current, and a signal controlled by said relays.

13. A signaling system comprising a source of power current, a feeder therefrom, track rails divided into block sections, reactance bonds interposed between said block sections, said track rails forming a return for the power current, a source of signaling current, feeders therefrom, a transformer in each block section having its primary connected across the alternating feeders and its secondary across the track, a transformer in each block section having its primary connected across the alternating feeders and its secondary in series with one rail of adjacent block sections, a relay energized by the difference of potential between the rails, a relay energized by the current flowing along the rail from one block section to the next, and a signal controlled by said relays.

In testimony whereof, I affix my signature, in the presence of two witnesses.

WINTHROP K. HOWE.

Witnesses:
A. F. DIETRICK,
E. C. BEYER.