No. 829,142.

PATENTED AUG. 21, 1906.

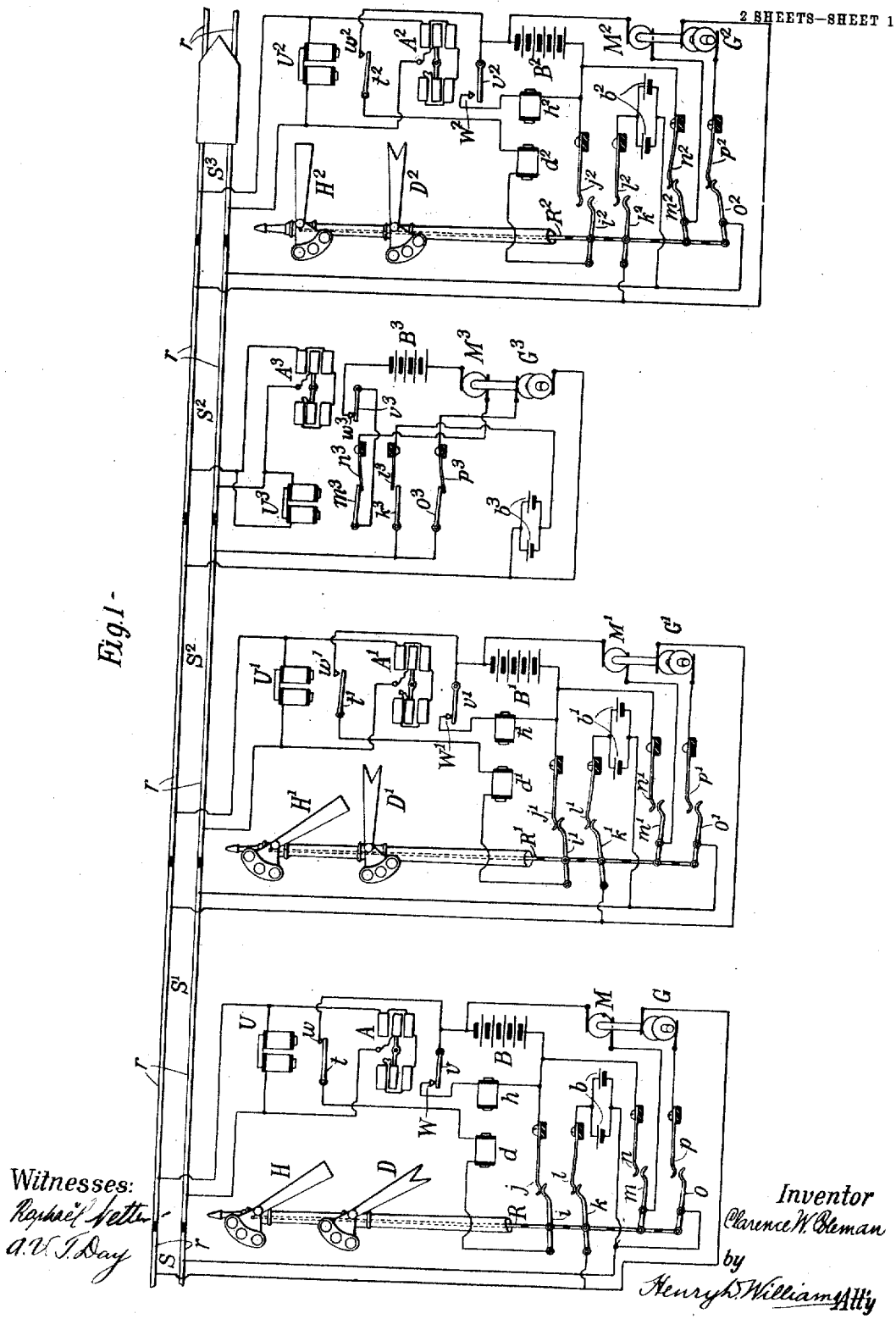
C. W. COLEMAN.

RAILWAY TRAFFIC CONTROLLING SYSTEM.

APPLICATION FILED FEB. 15, 1904.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 2

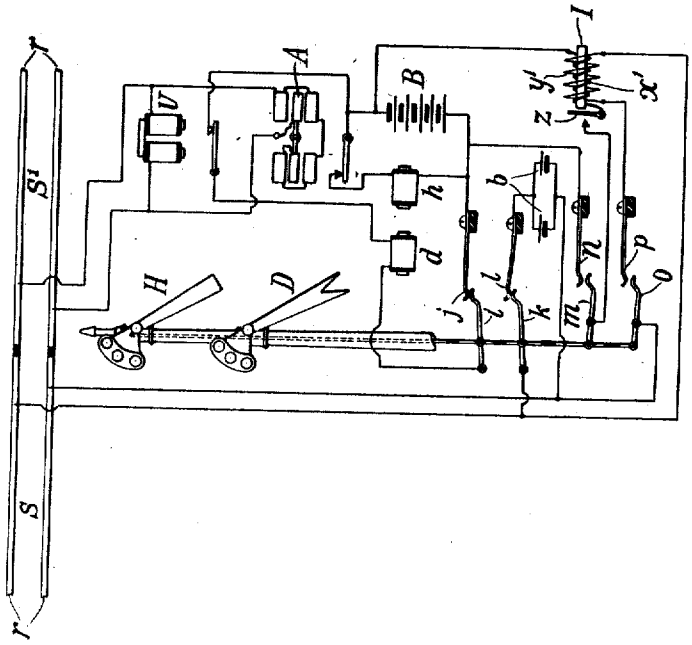
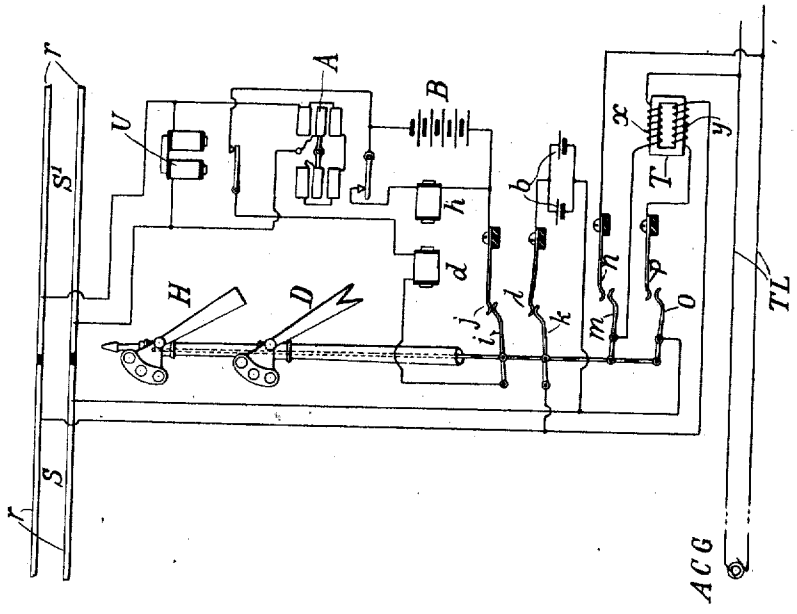


Fig. 3



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UNITED STATES PATENT OFFICE

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RAILWAY TRAFFIC-CONTROLLING SYSTEM.

No. 829,142. Specification of Letters Patent. Patented Aug. 21, 1906.

Application filed February 15, 1904. Serial No. 193,500.

To all whom it may concern.

Be it known that I, CLARENCE W. COLEMAN, a citizen of the United States, residing at Westfield, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Railway Traffic-Controlling Systems, of which the following is a specification, reference being had therein to the accompanying drawings, forming a part thereof.

My invention relates to systems and apparatus for controlling traffic upon railways by means of signals, switch-controlling means, and other means controlling the movements of trains or railway-vehicles.

My invention includes the employment of an electric current or currents having a number of current characteristics, including a current characteristic known as "periodic" and consisting in a periodic variation of fluctuation in a property of an electric current for selective control of the operations of the traffic-controlling apparatus.

My invention also includes the transmission of the controlling-currents or current characteristics to the traffic-controlling apparatus through conductive means including a common conductor or traffic-controlling circuit, and when thus transmitted the current characteristics affect the traffic-controlling apparatus differentially by virtue of their different electrical properties.

My invention also includes the employment, as such periodic current characteristic, of a periodic variation in the polarity or direction of a current such as exists in the ordinary commercial alternating current. In my invention the traffic-controlling means are capable of performing a number of operations and are selectively controlled to perform one or more of such operations by a controlling current or currents having a number of different characteristics, one of which is a periodic characteristic such as above referred to. In one form of my invention the home and distant signal indications are thus effected, and an alternating current is employed to effect the home clear indication, and a unidirectional current characteristic or direct current is employed to effect the distant clear indication. In one form of my invention the rails of the railway-track are the only conductors for the signal-controlling circuits from point to point along a railway-line, such a system being known as a "wireless-circuit" system.

My invention also includes various improvements in the construction, arrangement, and combination of circuits and apparatus embodied in the signaling system hereinafter particularly described.

The objects of my invention are economy and simplicity of construction and effectiveness, economy, and reliability of operation; and my invention has other objects and advantageous features, which will be evident from this specification.

I will now describe the systems shown in the accompanying drawings and embodying my invention and will thereafter point out my invention in claims.

The accompanying drawings are diagrammatic representations of three different embodiments of my invention which are particularly described hereinafter. These three particular embodiments are wireless automatic normal clear, home, and distant rail way block-signaling systems, which employ the periodic current characteristic residing in an alternating current for the selective actuation of the home signals and employ a direct-current or unidirectional-current characteristic for actuation of the distant signals. In these particular instances the two component controlling currents or current characteristics are transmitted over a common controlling-circuit comprising the rails of the railway-track as the only conductors of such circuit from point to point along the railway-line. In these instances such component currents, with their respective current characteristics, flow through their common traffic-controlling or signal circuit separately—that is, they are not normally superposed as components of one composite current having both current characteristics, but are only momentarily thus superposed within or upon their common circuit before the first-established or home-signal component is discontinued and after the second-established or distant-signal component is caused to flow.

Economy of current and wear upon the current-generating apparatus is the object of this arrangement, to effect which one operation of the traffic-controlling or signal-indicating apparatus, in these instances the clearing of the home signal, is made selectively controllable by or responsive to one current

characteristic, while another operation required to be performed after the first-mentioned operation, in these instances the clearing of the distant signal, is controllable by and responsive to the other current characteristic, the apparatus being also responsive to the latter current characteristic to maintain the position or condition thereof effected by the first operation and after the first-established current characteristic has been discontinued.

In the drawings, Figure 1 shows three blocks of a system in which normal clear signal-indicating apparatus is located at the rear end of each block. Figs. 2 and 3 show modifications of the system illustrated in Fig. 1.

In the system shown in Fig. 1 the home and distant signals of each signal-indicating apparatus are normally maintained in clear positions by passage of a unidirectional signal-clearing current from the next signal-indicating apparatus in advance through one rail r of the intervening block or section of the railway-line and thence through clearing and controlling electric translating apparatus or relays comprised in the signal-indicating apparatus at the rear end of the block—such as the ordinary relay U, responsive to unidirectional currents, and the relay A, of special construction and responsive to both alternating and direct currents—and thence through the other rail r and back to the apparatus at the advance end of the block. The home-signal clearing and controlling translating devices or relays, such as A, are in this instance constructed according to the principles of the well-known Kelvin balance, as indicated in the drawings, and in this instance the distant-signal clearing and controlling translating devices or relays, such as U, are made unresponsive to alternating current by means of their counter electromotive force of self-induction or what may be termed their "inductive resistance," which is so adjusted that the alternating current or current of periodic characteristic will pass only in small part through such distant-signal relays and not sufficiently to effectually energize them.

When a train is present in any block—for instance, as indicated, in the blocks S^3—the signal-clearing current instead of passing through the clearing-relays U^2 and A^2 at the rear end of the block passes directly from rail to rail through a low-resistance shunt or short circuit made by the wheels and axles of the train. Being thus deënergized, the clearing-relays U^2 and A^2 actuate their respective contact-fingers t^2 and v^2 or permit such fingers to be actuated by gravity or other force to open the contacts between such fingers and their respective contact-stops u^2 and w^2. The opening of the contacts v^2 w^2 of the home-signal-clearing relay A^2 opens the local circuit of the home-signal-controlling magnet h^2, which leads from the main battery B^2 through a connecting-wire to the contact-finger v^2, thence through contact-stop w^2, connecting-wire, home-signal-controlling magnet h^2, and connecting-wire back to battery. Through this local circuit the home-signal-controlling magnet is normally energized by current from the main battery B^2. The home-signal-controlling magnet h^2 and the distant-signal-controlling magnet d^2, respectively, control the home-signal semaphore H^2 and the distant-signal semaphore D^2, through interposed mechanism and apparatus well known in the art, in such manner that the energization of either of these controlling-magnets causes its respective semaphore to be placed in the clear position, and the deënergization of either magnet causes its respective semaphore to be moved by counterweight or other force to the danger position. Thus the deënergization of the home-signal-controlling magnet h^2, effected by the deënergization of the home-signal-clearing relay A^2, causes the home-signal semaphore H^2 to go to the position indicating "danger." The distant-signal semaphore D^2 is likewise caused to move to danger position by deënergization of the distant-signal-controlling magnet d^2, which is effected by opening the contacts t^2 u^2, controlled by the distant-signal-clearing relay U^2, as already pointed out, and included in the local circuit of the distant-signal-controlling magnet, which is as follows: from main battery B^2 through connecting-wire, contact-stop u^2, contact-finger t^2, connecting-wire, distant-signal-controlling magnet d^2, connecting-wire, contact-lever i^2, contact-stop j^2, and connecting-wire back to battery. The contact-levers i^2, k^2, m^2, and o^2 are all actuated by or together with the movement of the home-signal semaphore H^2, the actuating means being represented in the diagram by a common rod R^2, connected at its lower end to each of these levers and at its upper end to the semaphore. Suitable insulation is provided to prevent conductive connection from one lever to another through the rod. By the movement of the home signal to "danger" the contact-lever i^2 is actuated to positively break contact with its stop j^2, and thus positively break the local circuit of the distant-signal-controlling magnet d^2 and cause the distant signal to go to "danger" even if such local circuit should fail to be effectually broken by the contacts t^2 u^2, because of sticking, arcing, or other unusual condition.

The railway-block S^2 (shown in the diagram in rear of the block S^3) represents an unusually long railway-block or a railway-block so situated as to be liable to abnormally wet conditions. To avoid unreliability or uncertainty in the actuation of the signal-indicating apparatus at the rear end of such a block, such as might ensue from

loss of power in the signal-actuating currents, due to unusual resistance of an unusually long rail-circuit or due to excessive leakage from rail to rail through an abnormally wet rail-circuit, this particular block is divided into two successive subsections insulated from each other, but having a signal-current-repeating apparatus interposed between them by connection to the rear end of the rail-circuit of the forward subsection and to the advance end of the rail-circuit of the rear subsection.

Assuming that the railway-train has entered the block or section S^3 in its ordinary progressive movement along the railway-line and from the block S^2 in rear of the block S^3, it will be noted that just prior to such entrance of the train upon the block S^3 the wheels and axles of such train constitute a short circuit from rail to rail of the rail-circuit of the advance subsection of the railway-block S^2. This short circuit until it is broken by exit of the train from the block S^2 effectually shunts all current transmitted from the signal-indicating apparatus at the rear end of the block S^3 to the advance end of such rail-circuit and prevents the transmission of such current along this rail-circuit to points in rear of the train. In the absence of such current at the rear end of the rail-circuit of the forward subsection of the block S^2 the home-signal-repeating relay A^3 and the distant-signal-repeating relay U^3, comprised in the signal-current-repeating apparatus and connected in multiple at the rear end of such rail-circuit, are both deënergized. In this condition of the repeating-relays the signal-current-repeating apparatus transmits no clearing-current to the rail-circuit of the rear subsection of the railway-block S^2, and in such absence of clearing-current both the home-signal semaphore H' and the distant semaphore D' of the signal-indicating apparatus at the rear end of this block are in their danger positions.

Upon exit of the train from the block S^2 into the block S^3 and when the signals at the rear end of the latter block go to "danger" the movement of the home-signal to "danger" causes the contact-lever k^2 to break its contact with the contact-spring l^2, and thus breaks the delivery-circuit of the two multiple cells of the track-battery b^2, through which these cells deliver unidirectional current to the advance end of the rail-circuit of the advance subsection of the block S^2, this delivery-circuit being as follows: from one rail of the subsection through wire connection to the contact-lever k^2, thence through the contact-spring l^2 to one pole of the battery b^2, through the battery, and thence by a wire connection back to the other rail of the subsection. The same movement of the home-signal semaphore causes the contact-lever m^2 to make contact with the contact-spring n^2, thus closing the local circuit of the motor-armature M^2 of a motor-generator comprised in the signal-indicating apparatus, this local motor-circuit being as follows: from one pole of the main battery B^2 to one brush of the motor-armature, thence through the armature, the other brush, wire connection, contact-lever m^2, contact-spring n^2, and wire connection back to the other pole of the battery. The same movement of the home-signal semaphore causes the contact-lever o^2 to make contact with its contact-spring p^2, and thus closes the circuit of the alternating-current-generator armature G^2 of the motor-generator, through which circuit this generator-armature delivers alternating or home-signal-clearing current to the advance end of the rail-circuit of the advance subsection of the railway-block S^2. This delivery-circuit of the alternating-current generator is as follows: from the advance end of one rail of the rail-circuit through wire connection to one brush of the armature G^2, through the armature to the other brush, and thence through wire connection, contact-spring p^2, contact-lever o^2, and wire connection to the advance end of the other rail of the rail-circuit. The contact-springs are so adjusted relative to their respective contact-levers that the aforedescribed circuits of the motor-armature and of the generator-armature of the motor-generator are closed during the movement of the home-signal semaphore H^2 to "danger" before such movement opens the delivery-circuit of the direct-current track-battery b^2. The duration of the direct current flowing from this battery to its rail-circuit after the entrance of the train upon the block S^3 is, however, only momentary and produces no clearing effect upon the signal-indicating apparatus at the rear end of such block.

Upon closing of the circuits of the motor and generator armatures of the motor-generator resulting from the movement of the home signal H^2 to "danger" the motor-generator M^2 G^2 is started by its motor-armature and its generator-armature commences to deliver alternating current to the advance rail-circuit of the railway-block S^2, the function of which alternating current is to clear the home signal at the rear end of that block. This home-signal-clearing current traverses the advance rail-circuit of the block S^2, passes through the home-signal-repeating relay A^3, which is of similar construction to the other home-signal-clearing relays, such as A, and is responsive to both alternating and direct currents and energizes this relay. The distant-signal-repeating relay U^3 is of similar construction to the other distant-signal-clearing relays, such as U, and although connected in the rear end of this same rail-circuit in multiple with the home-signal-repeating relay the inductive resistance of the distant-signal-repeating relay is so adjusted that this

alternating current passes only in small part through it and not sufficiently to energize it. The energization of the home-signal-repeating relay A^3 causes this relay to move its contact-finger v^3 into contact with the contact-stop w^3, thus closing the local circuit of the armature M^3 of the motor-generator of the repeating apparatus. This motor-armature circuit is as follows: from one pole of the battery to one brush of the motor-armature, thence through the armature to the other brush, thence through connecting-wire, contact-spring n^3, contact-finger m^3 controlled by the distant-signal-repeating relay U^3 and in closed position when this relay is deënergized, and from the contact-finger m^3 through wire connection, contact-finger v^3, contact-stop w^3, and wire connection back to the other pole of the battery. The closing of this motor-armature circuit starts the motor-generator, and the alternating-current-generator armature thereof commences to deliver an alternating current or home-signal-clearing current to the advance end of the rear rail-circuit of the railway-block S^2 through a delivery-circuit which may be traced from the advance end of one rail of such rail-circuit by wire connection to one brush of the alternating-current armature and from the advance end of the other rail of such rail-circuit, through wire connection, contact-finger o^3, its contact-spring p^3, and wire connection to the other brush of the armature. The contact-finger o^3 is controlled by the direct-current or distant-signal-repeating relay U^3 and is in circuit-closing position when this repeating-relay is deënergized. A contact-finger k^3, which is also controlled by the distant-signal-repeating relay U^3, but only brought into contact with its contact-spring l^3 when this relay is energized, controls the delivery-circuit of the direct-current distant-signal-clearing battery b^3, which delivery-circuit is as follows: from the advance end of one rail of the rear rail-circuit of the block S^2, through connecting-wire to one pole of the battery, thence through the battery and connecting-wire to the contact-spring l^3, thence through contact-finger k^3 and connecting-wire to the advance end of the opposite rail of this rail-circuit.

The alternating current or home-signal-clearing current from the generator-armature G^3 traverses the rear rail-circuit of the block S^2 to the rear end of such rail-circuit and of such block and thence passes through wire connection, by means of which the home and distant signal clearing relays A′ and U′, respectively, are included in multiple with each other. This alternating current does not energize the distant-signal-clearing relay U′ for reasons already set forth. The home-signal-clearing relay A′ is, however, energized by this alternating current and raises its contact-finger v' into position of contact with the contact-stop w', thus closing the local circuit of the home-signal-controlling magnet h', which corresponds to the local circuit of the home-signal-controlling magnet h^2, which has already been traced at the rear end of the block S^3. Thereby the home-signal-controlling magnet h' is energized and the home-signal semaphore H′ is consequently placed in clear position in a manner already described. The signal-indicating apparatus at the rear end of the block S^2 now gives the one block clear indication, and this condition of the apparatus exactly corresponds to the condition of the corresponding signal-indicating apparatus at the rear end of the block S′ prior to the exit of the train from a block S^2 and at the moment of clearing the home signal at the rear end of such block. Upon such clearing of the rear home signal of the block S^2 and by the clearing movement thereof the contact-lever k' is brought into contact with its contact-spring l' to close the delivery-circuit of the direct-current or distant-signal-clearing battery b', which delivery-circuit corresponds to that of the clearing-battery b^2 already described. By the same movement the motor and generator circuits of the motor-generator corresponding to the motor and generator circuits already described at the rear end of the block S^3 are open, but not before, and preferably an instant after, the closure of the delivery-circuit of the direct-current battery b', through which it transmits distant-signal-clearing current to the advance end of the rail-circuit of the block S′. This distant current or distant-signal-clearing current traverses the rail-circuit of the block S′ to the rear end thereof and thence passes through and energizes the distant-signal-clearing relay U and maintains the energization of the home-signal-clearing relay A, the distant-signal relay being responsive to a direct current and the home-signal relay being responsive to either a direct or an alternating current.

The distant-signal-clearing relay U when it is energized moves its contact-finger t into contact with its contact-stop U, thereby closing the local circuit of the distant-signal-controlling magnet d, which is the same as the corresponding circuit already described in connection with the apparatus at the rear end of the block S^3. The home signal at the rear end of the block S′ being already clear, the contacts i j, controlled by such home signal and interposed in the local circuit of the distant-signal-controlling magnet, are already closed, so that this local circuit is completed and the distant-signal-controlling magnet d is energized immediately upon closure of the contacts t u. This energization of the distant-signal-controlling magnet d clears the distant signal D at the rear end of the block S′, thereby giving the two blocks clear indication at the rear end of this block.

The clearing movement of the home-signal semaphore H′ at the rear end of the block S^2, by means of which the distant-signal-clearing current is transmitted to the signal-indicating apparatus at the rear end of the block S′, also brings the lever i' into contact with its contact-stop j' preparatory to complete closure of the local circuit of the distant-signal-controlling magnet d' when the other controlling-contacts thereof t' u' shall be closed by the passage of direct current or distant-signal-clearing current through the distant-signal-clearing relay U′.

It will be noted that although the alternating current or home-signal-clearing current has been cut off from the block S′ by the clearing movement of the rear home signal of the block S^2 the home-signal-clearing relay A at the rear end of the block S′ is still energized and maintained in signal-clearing position by passage of the direct or distant-signal-clearing current through it.

Upon exit of the train from the block S^3 the rear home signal H^2 of that block will be cleared by an alternating home-signal-clearing current transmitted through the rail-circuit of this block and from the signal-indicating apparatus at the advance end thereof in the manner already described with respect to the clearing of the rear home signal of the block S^2, excepting that the home-signal-clearing current may be transmitted through the rail-circuit of the block S^3 directly from its advance end and without the interposition of signal-current-repeating apparatus. Thereupon the clearing movement of the rear home signal H^2 of the block S^3 will terminate the alternating or home-signal-clearing current transmitted through the advance rail-circuit of the divided block S^2, but only after establishing a direct or distant-signal-clearing current from the track-battery b^2 through such advance rail-circuit to maintain the home-signal-repeating relay A^3 in signal-clearing position or condition and to energize the distant-signal-repeating relay U^3 responsive only to direct current. This energization of the distant-signal-repeating relay U^3 opens the motor-armature circuit of the motor-generator M^3 G^3 and the delivery-circuit of the generator-armature thereof at the contacts m^3 n^3 and o^3 p^3, respectively, but not until after closing the delivery-circuit of the direct-current distant-signal-clearing battery b^3 at the contacts k^3 l^3 by reason of the adjustment of the contact-springs n^3, p^3, and l^3 relative to their respective contact-fingers.

It is apparent that the foregoing operation of the signal-current-repeating apparatus effects a cessation of the alternating or home-signal-clearing current traversing the rear rail-circuit of the divided block S^2 and maintaining its rear home signal in clear position, but only after establishing a direct or distant-signal-clearing current in such circuit to clear the distant signal at the rear end thereof by energizing the direct current or distant-signal-clearing relay U′ and to maintain the energization and clearing position or condition of the home-signal-clearing relay A′ at the rear end of such block. The effect of the signal-current-repeating apparatus interposed between the adjacent subsections of the railway-block S^2 is merely to transmit to the rear rail-circuit of such block the same kind of current or currents which the repeating apparatus receives from the advance rail-circuit of such block.

Figs. 2 and 3 represent signal-indicating apparatus of the same construction as represented at the rear end of each block of the system shown in Fig. 1, excepting as to the means for producing the alternating current or home-signal-clearing current. In each of these figures the signal-indicating apparatus at the rear end of one block only is shown. In the apparatus shown in Fig. 2 the motor-generator of the signal-indicating apparatus of Fig. 1 is replaced by an induction-coil I, the primary circuit of which comprises a primary coil x' and a circuit-breaking device z, which may be actuated by the core of the induction-coil in a well-known manner. In its relation to the rest of the apparatus this primary circuit corresponds to the motor-armature circuit of the motor-generator of the system shown in Fig. 1 and is similarly supplied with circuit from the main battery B, controlled by the contact-lever m and its contact-spring n. The secondary coil y' corresponds with the generator-armature of the motor-generator in function and in its connection with the rail-circuit in rear of the apparatus and in its method of control by the contact-lever o and contact-spring p. The current produced by this secondary coil is a non-symmetrical alternating current—that is, an alternating current whose opposing signs have different values or whose opposing current-waves may have different forms. In the signal-indicating apparatus shown in Fig. 3 the alternating or home-signal-clearing current is supplied by a transformer T, the secondary coil y of which corresponds to the generator-armature of the motor-generator already described in function and in its connection with the signal-indicating apparatus and the rail-circuit in rear thereof. The primary coil x of this transformer is in a circuit which supplies it with an alternating current and which is controlled by the contact-lever m and the contact-spring n in the manner already described with reference to the control of the motor-armature circuit of the motor-generator. In the apparatus shown in Fig. 3, however, this primary circuit of the transformer connects with and is supplied by the wires of a transmission-line T L, connecting with an alternating-current generator A C G, located at some

convenient point. It is of course obvious that such a transmission-line extending along a railway-track may supply alternating current to any number of signal-indicating apparatuses.

It is obvious that various other modifications of the constructions shown and above particularly described may be made within the spirit and scope of my invention.

What I claim, and desire to secure by Letters Patent, is—

1. The combination of electrically-controllable railway traffic-controlling apparatus differentially responsive to different current characteristics and means for supplying electricity having a number of current characteristics including a periodic alternation, the traffic-controlling apparatus being in controllable relation to the means for supplying electricity through suitable conductive means including a conductor common to the different current characteristics.

2. The combination of electrically-controllable railway traffic-controlling apparatus differentially responsive to different current characteristics, and means for supplying electricity having a number of current characteristics including a periodic alternation, such means for supplying electricity being governable by movement of a railway-vehicle along the railway-line and being in controlling relation to the traffic-controlling apparatus through suitable conductive means including a conductor common to the different current characteristics.

3. The combination of electrically-controllable railway signal-indicating apparatus differentially responsive to different current characteristics and means for supplying electricity having a number of current characteristics including a periodic alternation, the signal-indicating apparatus being in controllable relation to the means for supplying electricity through suitable current-transmitting means including a conductor common to the different current characteristics.

4. The combination of electrically-controllable railway signal-indicating apparatus differentially responsive to different current characteristics, and means for supplying electricity having a number of current characteristics including a periodic alternation, such means for supplying electricity being governable by movement of a railway-vehicle along the railway-line and being in controlling relation to the signal-indicating apparatus through suitable current-transmitting means including a conductor common to the different current characteristics.

5. The combination of electrically-controllable railway traffic-controlling apparatus and means for producing electricity having a number of current characteristics including a periodic variation, the traffic-controlling apparatus being in controllable relation to the electricity producing means through suitable current-transmitting means including a conductor common to the different current characteristics, and such traffic-controlling apparatus being selectively responsive to one of the current characteristics to effect one condition of the traffic-controlling apparatus and responsive to another of the current characteristics to effect another condition of the traffic-controlling apparatus and to maintain the first-mentioned condition thereof.

6. The combination of electrically-controllable railway traffic-controlling apparatus selectively responsive to a periodic current characteristic to effect one condition of the traffic-controlling apparatus and responsive to another current characteristic to effect another condition of the traffic-controlling apparatus and to maintain the first-mentioned condition thereof, and means for producing electricity having a number of current characteristics including a periodic characteristic, the traffic-controlling apparatus being in controllable relation to the electricity producing means through suitable current-transmitting means including a conductor common to the different current characteristics.

7. The combination of electrically-controllable railway traffic-controlling apparatus, means for supplying electricity having a number of current characteristics including a periodic variation, the traffic-controlling apparatus being differentially responsive to the different current characteristics and being in controllable relation to the means for supplying electricity through suitable current-transmitting means including a conductor common to the different current characteristics, and means for controlling one current characteristic from a point in advance of the traffic-controlling apparatus along the railway-line and for controlling another current characteristic from a point farther in advance thereof along the railway-line.

8. The combination of electrically-controllable railway traffic-controlling apparatus, means for supplying electricity having a number of current characteristics including a periodic variation, the traffic-controlling apparatus being differentially responsive to the different current characteristics and being in controllable relation to the means for supplying electricity through conductive means including a conductor common to the different current characteristics and means for controlling either current characteristic from a point in advance of the traffic-controlling apparatus along the railway-line and for controlling one current characteristic from a point farther in advance thereof along the railway-line.

9. The combination of electrically-controllable railway signal-indicating apparatus,

means for supplying electricity having a number of current characteristics including a periodic variation, the signal-indicating apparatus being differentially responsive to the establishment of different current characteristics to effect different clear indications and being in controllable relation to the means for supplying electricity through conductive means including a conductor common to the different current characteristics and means for controlling one current characteristic from a point in advance of the traffic-controlling apparatus along the railway-line and for controlling another current characteristic from a point farther in advance thereof along the railway-line.

10. The combination of electrically-controllable railway traffic-controlling apparatus, a controlling rail-circuit in controlling relation to the traffic-controlling apparatus and extending in advance thereof, and means for supplying to the controlling rail-circuit electricity having a number of current characteristics including a periodic variation, the traffic-controlling apparatus being differentially responsive to each of such current characteristics, and being responsive to one of such current characteristics to maintain the condition effected by the other current characteristic.

11. The combination of electrically-controllable railway traffic-controlling apparatus, a circuit in controlling relation to the traffic-controlling apparatus, means for supplying to the controlling-circuit electricity having a number of current characteristics including a periodic variation the traffic-controlling apparatus being differentially responsive to such current characteristics, and another traffic-controlling apparatus in controlling relation to the controlling-circuit and controlling one of the current characteristics.

12. The combination of electrically-controllable railway traffic-controlling apparatus, a circuit in controlling relation to the traffic-controlling apparatus, means for supplying to the controlling-circuit electricity having a number of current characteristics including a periodic variation the traffic-controlling apparatus being differentially responsive to such current characteristics, and another traffic-controlling apparatus in controlling relation to the controlling-circuit and controlling both of the current characteristics.

13. The combination of electrically-controllable railway traffic-controlling apparatus differentially responsive to different current characteristics including a periodic variation, a controlling rail-circuit in controlling relation to the traffic-controlling apparatus, means for supplying to such controlling-circuit electricity having a number of current characteristics including a periodic variation, and another traffic-controlling apparatus in controlling relation to such controlling-circuit and controlling either current characteristic thereof.

14. The combination of electrically-controllable railway traffic-controlling apparatus differentially responsive to different current characteristics, a controlling-circuit in controlling relation thereto, means for supplying to such controlling-circuit electricity having a number of current characteristics including a periodic variation, another electrically-controllable railway traffic-controlling apparatus in controlling relation to the said controlling-circuit and controlling one of its current characteristics, and another controlling-circuit in controlling relation to the second traffic-controlling apparatus, and means for supplying electricity to the second controlling-circuit.

15. The combination of electrically-controllable railway traffic-controlling apparatus, means for supplying electricity having a number of current characteristics including a periodic variation, the traffic-controlling apparatus being in controllable relation to the means for supplying electricity through suitable conductive means including a conductor common to the different current characteristics, and such traffic-controlling apparatus being differentially responsive to the different current characteristics, and means for controlling one current characteristic from a distant point along the railway-line and for controlling another current characteristic from a more distant point along the railway-line.

16. The combination of electrically-controllable railway traffic-controlling apparatus, means for supplying electricity having a number of current characteristics including a periodic variation, the traffic-controlling apparatus being in controllable relation to the means for supplying electricity through suitable conductive means including a conductor common to the different current characteristics, and such traffic-controlling apparatus being differentially responsive to the different current characteristics, and means for controlling one current characteristic by presence of a railway-vehicle in one railway-block of the railway-line and for controlling another current characteristic by presence of a railway-vehicle in another block of the railway-line.

17. The combination of electrically-controllable railway traffic-controlling apparatus, means for supplying electricity having a number of current characteristics including a periodic variation, the traffic-controlling apparatus being in controllable relation to the means for supplying electricity through suitable conductive means including a conductor common to the different current characteristics, and such traffic-controlling apparatus being differentially responsive to the

different current characteristics, and means for controlling two current characteristics by presence of a railway-vehicle in one railway-block of the railway-line and for controlling one of such two current characteristics by presence of a railway-vehicle in another block of the railway-line.

18. The combination of electrically-controllable railway traffic-controlling apparatus, means for supplying electricity having a number of current characteristics including a periodic variation, the traffic-controlling apparatus being in controllable relation to the means for supplying electricity through suitable conductive means including a conductor common to the different current characteristics, and such traffic-controlling apparatus being differentially responsive to the different current characteristics, and means for controlling one current characteristic by presence of a railway-vehicle in a block or section of the railway-line in advance of the traffic-controlling apparatus and for controlling another current characteristic by presence of a railway-vehicle in another railway-block next in advance of such traffic-controlling apparatus.

19. The combination of electrically-controllable railway traffic-controlling apparatus, means for supplying electricity having a number of current characteristics including a periodic variation, the traffic-controlling apparatus being differentially responsive to the different current characteristics and being in controllable relation to the means for supplying electricity through suitable current-transmitting means including a conductor common to the different current characteristics, and means for controlling two current characteristics from a distant point along the railway-line and for controlling one of such current characteristics from a point farther distant along the railway-line.

20. The combination of electrically-controllable railway traffic-controlling apparatus located at one end of a railway block or section and comprising an electric translating device governing such traffic-controlling apparatus, and at the other end of the railway-block a means for supplying electricity having a number of current characteristics including a periodic variation, the translating device being in controllable relation to the means for supplying electricity through suitable current-conductive means and being subjected to the tendencies of the various current characteristics and being selectively responsive to one of such current characteristics.

21. The combination of electrically-controllable railway traffic-controlling apparatus comprising an electric translating device governing such traffic-controlling apparatus, and means for supplying electricity having a number of current characteristics including a periodic alternation, the translating device being in controllable relation to the means for supplying electricity and being in circuit with and subjected to the tendencies of its various current characteristics and being selectively responsive to one of such current characteristics.

22. The combination of electrically-controllable railway traffic-controlling apparatus located at one end of a railway block or section and comprising a plurality of electric translating devices governing such apparatus, and at the other end of the railway-section a means for supplying electricity having a number of current characteristics including a periodic variation, the translating devices being in controllable relation to the means for supplying electricity and being in circuit with its various current characteristics but one of the translating devices being responsive to selective actuation by one current characteristic and another translating device being responsive to another current characteristic.

23. The combination of electrically-controllable railway traffic-controlling apparatus located at one end of a railway block or section and comprising a plurality of electric translating devices governing such apparatus, and at the other end of the railway-section a means for supplying electricity having a number of current characteristics including a periodic variation, the translating devices being in controllable relation to the means for supplying electricity and being in circuit with its various current characteristics but one of the translating devices being responsive to selective actuation by the characteristic of periodic variation and another translating device being responsive to another current characteristic.

24. The combination of electrically-controllable railway traffic-controlling apparatus comprising a pluraliyt of electric translating devices governing such apparatus, and means for supplying electricity having a number of current characteristics including a periodic alternation, the translating devices being in controllable relation to the means for supplying electricity and being in circuit with its various current characteristics but one of the translating devices being responsive to selective actuation by the characteristic of periodic alternation and another translating device being responsive selectively to another current characteristic.

25. The combination of electrically-controllable railway signaling apparatus responsive to different current characteristics to give different clear indications and means for supplying electricity having components with a number of current characteristics including a component of uniform unidirectional current characteristic and a component having a current characteristic of peri-

odic variation, the signaling apparatus being in controllable relation to the means for supplying electricity through suitable conductive means including a conductor common to all the said current components.

26. The combination of electrically-controllable railway traffic-controlling apparatus differentially responsive to a unidirectional current characteristic and to a current characteristic of periodic alternation, and means for supplying electricity having such current characteristics, such means for supplying electricity being governable by movement of a railway-vehicle along the railway-line and being in controlling relation to the traffic-controlling apparatus through suitable conductive means including a conductor common to the different current characteristics.

27. The combination of electrically-controllable home and distant railway signal-indicating apparatus, and means for supplying electricity having a number of current characteristics including a periodic variation, the signal-indicating apparatus being in controllable relation to the means for supplying electricity through suitable conductive means including a conductor common to all the said current characteristics and such signal-indicating apparatus being differentially responsive to the different current characteristics to control its home and distant indications.

28. The combination of electrically-controllable home and distant railway signal-indicating apparatus, and means for supplying electricity having a number of current characteristics including a periodic variation, such means for supplying electricity being governable by a movement of a railway-vehicle along the railway-line and being in controlling relation to the signal-indicating apparatus through suitable conductive means including a conductor common to the different current characteristics, and the signal-indicating apparatus being selectively responsive to one of the current characteristics to control the home-signal indication thereof and being responsive to another of the current characteristics to control the distant-signal indication thereof.

29. The combination of electrically-controllable railway traffic-controlling apparatus comprising a plurality of electric relays including a Kelvin balance-relay, such relays governing the traffic-controlling apparatus, and means for supplying electricity having a number of current characteristics including a periodic variation, the electric relays being in controllable relation to the means for supplying electricity and being in circuit with its various current characteristics but the Kelvin balance-relay being responsive to selective actuation by one current characteristic and another relay being responsive to another current characteristic.

30. The combination of electrically-controllable railway traffic-controlling apparatus differentially responsive to different current characteristics and means for supplying electricity having a number of current characteristics including a periodic variation, the traffic-controlling apparatus being in controllable relation to the means for supplying electricity through suitable current-transmitting means including a current-repeating apparatus.

In testimony whereof I have affixed my signature in presence of two witnesses.

CLARENCE W. COLEMAN.

Witnesses:

HENRY D. WILLIAMS,
HENRY BARNES.