J. B. STRUBLE.

ALTERNATING CURRENT BLOCK SIGNALING SYSTEM.

APPLICATION FILED APR. 1, 1908.

899,353.

Patented Sept. 22, 1908.

2 SHEETS—SHEET 1.

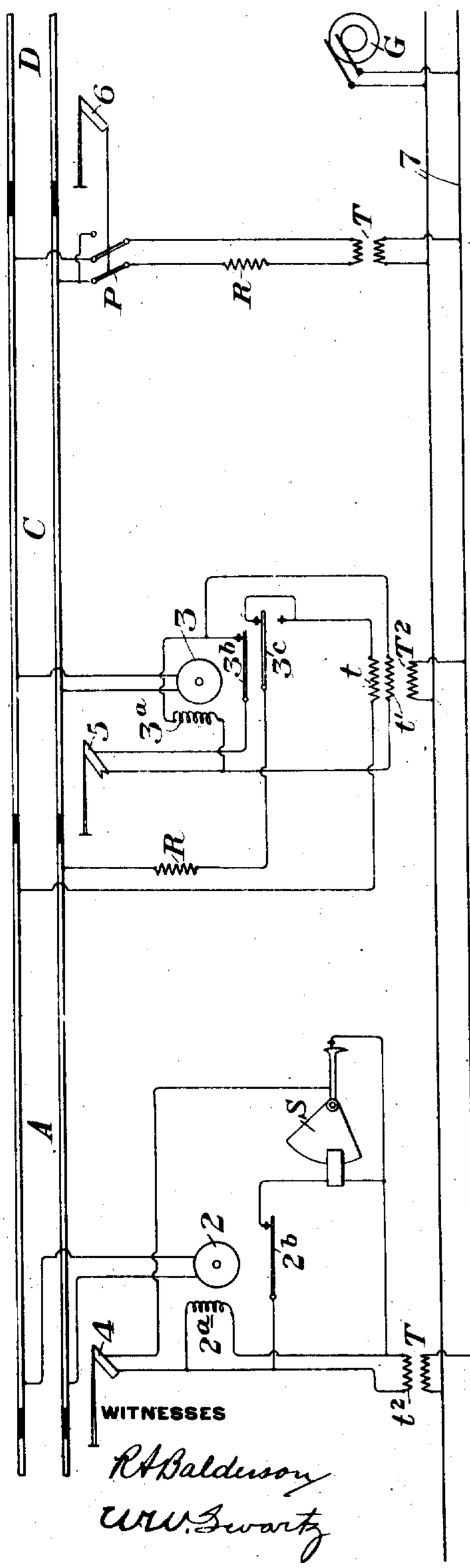

FIG. 1.

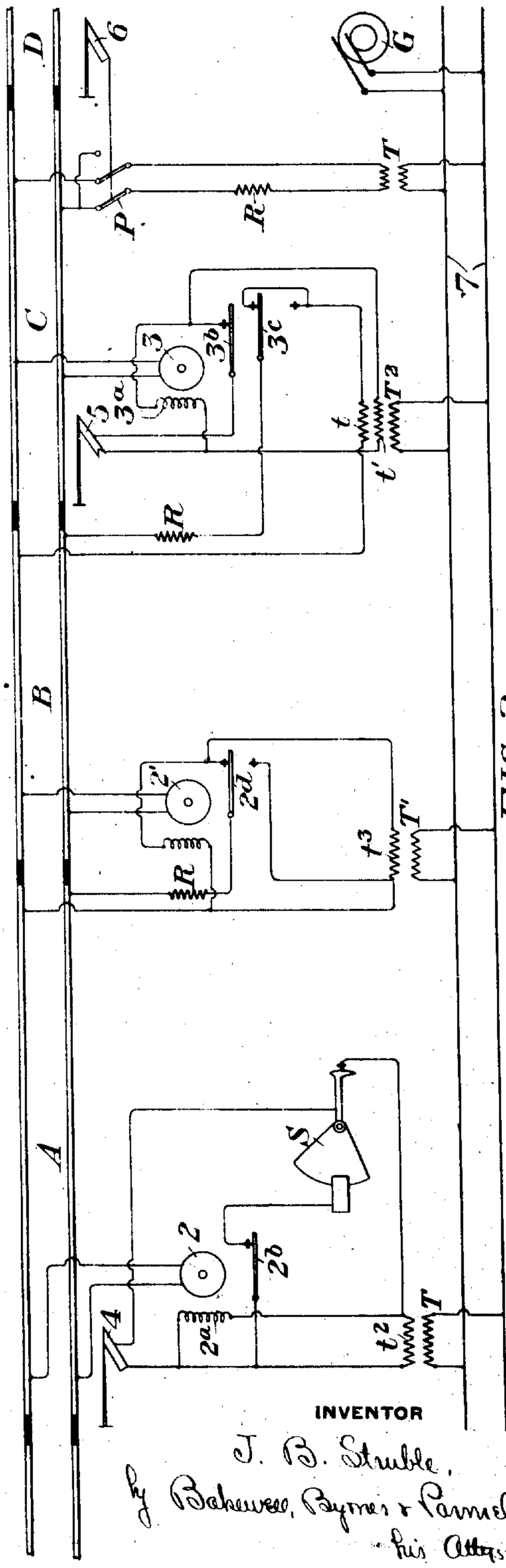

FIG. 2.

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2 SHEETS—SHEET 2.

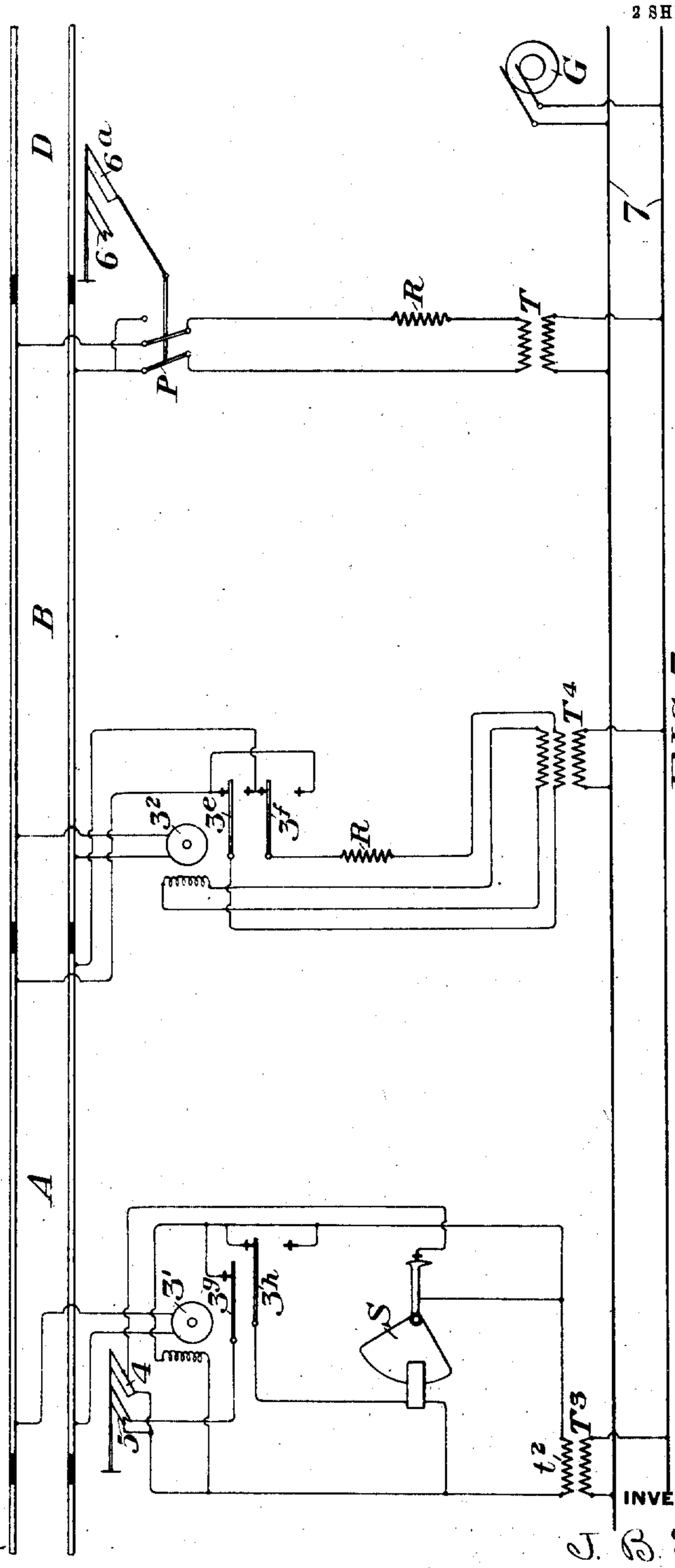

FIG. 3.

WITNESSES

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UNITED STATES PATENT OFFICE.

JACOB B. STRUBLE, OF SWISSVALE, PENNSYLVANIA, ASSIGNOR TO THE UNION SWITCH & SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

ALTERNATING-CURRENT BLOCK-SIGNALING SYSTEM.

No. 899,353. Specification of Letters Patent. Patented Sept. 22, 1908.

Application filed April 1, 1908. Serial No. 424,628.

To all whom it may concern:

Be it known that I, JACOB B. STRUBLE, of Swissvale, Allegheny county, Pennsylvania, have invented a new and useful Alternating-Current Block-Signaling System, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figures 1, 2 and 3, are diagrams showing three different arrangements of circuits and operating devices embodying my invention.

My invention has relation to an alternating current block signaling system, and is designed to provide means for controlling the operation of the distant signals without the use of wires extending back from the home signals to the corresponding distant signals. I accomplish this object by the provision of relays and controlling circuits therefor, so arranged that the supply of current for the distant signals is cut off and the signals are held at caution position until the corresponding home signal has cleared, with means for thereby restoring the current supply to the distant signal and clearing it.

The precise nature of my invention will be best understood by reference to the accompanying drawings in which I have shown several different embodiments thereof, and which will now be described, it being premised, however, that the invention is susceptible of various changes and of other embodiments, without departing from its spirit and scope, as defined in the appended claims.

Referring first to Fig. 1 of the drawings, A, C, D are three successive sections of a railway track, insulated one from another, as indicated. The sections A and C constitute portions of one and the same block, which is guarded by the home signal 4. The section D constitutes the first section or subdivision of the next block, which is guarded by the home signal 6. 5 is the distant signal for the last named block, and which, in the forms of my invention shown in Figs. 1 and 2, is mounted on a separate pole or support located beyond the home signal 4 in the direction of travel of the trains. G is a generator of the alternator type which supplies signaling current to the track through the line conductors 7 and the transformers T and T^2. The transformers T, T supply current respectively to the sections A and C. The transformer T^2 has one secondary winding t which is also arranged to supply current to the section A, and another winding t' which supplies current to set and hold the distant signal 5 at clear position. 2 designates a relay of the motor type, having the winding of its armature connected across the rails of track section A and its field winding 2^a in series with the secondary t^2 of the transformer T. Relay 2 has two positions, the one shown in the drawing in which the contact arm 2^b actuated thereby is in position to close the circuit for the slow release relay S, which in turn is in position to close the circuit for the home signal 4, and another position in which said circuit is opened. S is a second relay, of the vane type which is connected in multiple with the relay coil 2^a for a purpose presently to be described. 3 is a relay which has its armature winding connected across the rails of track section C, and its field 3^a in a multiple circuit to the secondary winding t' of transformer T^2. The relay 3 is preferably of the type having a wire wound field and armature, and having three positions; that is to say, arranged to control a circuit in each extreme position, and an intermediate position in which all the circuits which it controls are opened. It has one contact arm 3^b in series with the circuit which controls the distant signal 5, and another contact arm 3^c which controls contacts in series with the transformer secondary t. Arm 3^c has also front and back contacts in parallel so that when in either of its extreme positions, the circuit of the secondary t will be closed. R wherever seen indicates resistance. P is a pole changer actuated by the home signal 6 to reverse the polarity of the track section C. The position of the pole changer determines the polarity or phase relation of the current in the rails of section C and in the armature of the relay 3 with relation to the current in the field winding 3^a, and therefore determines the direction of rotation of the armature. The resistance R serves the purpose of preventing an excessive flow of current from the track transformers to the rails when a track section is occupied by a train.

It will be understood that in practice, home signal 4 will actuate a corresponding pole changer for the preceding track section; also that the signal 6 and track section D will have a relay corresponding to the relay 2. To simplify the drawings, these have been omitted.

Supposing a train to be passing from left to right on the drawing, the action is as follows:—As soon as the train enters the track section A, the armature of relay 2 is short circuited, and relays 2 and S move to open circuit position, and set signal 4 at danger. When the train enters section C, the armature of the relay 3 is short circuited, and the relay assumes its middle position which opens all its contacts, thus setting the distant signal 5 at caution and also cutting off the supply of current to the track section A. When the train enters section D, the home signal 6 is set at danger and the pole changer P is thereby shifted to supply current to the track section C in an opposite direction. This energizes the relay 3 in such a manner as to close the contact arm 3^c against its back contact but to retain in its open position the contact arm 3^b which controls the actuating circuit of the distant signal 5. The home signal 4 is now again supplied with current from the track circuit, and goes to clear position. When the train passes off from the block D, the home signal 6 clears, and the pole changer P is shifted to its original position. The current in the armature 3 is therefore again reversed and its armature turns in the reverse direction, thereby closing contact arm 3^b and moving contact arm 3^c against its front contact. The closing of contact arm 3^b supplies current to the distant signal 5, which then clears; the supply of current to track section A being continued through the arm 3^c. The momentary interruption of the current supply to track circuit A while the relay 3 is shifting, is bridged over by the vane relay S. This is due to the fact that this relay has a slow release by reason of the inertia of the moving element, its contact being so designed that a slight movement of the vane will not open the circuit; that is to say, before the vane can move far enough to open the signal circuit, the current is reëstablished in its winding which returns the vane to its fully closed position. If the home signal were of the ordinary slot-controlled type, the momentary opening which would occur without the relay S during the shifting interval of the relay 3, would cause the signal to go to danger in the face of a possible approaching train. This would be undesirable even though the signal immediately returned to the clear position.

The arrangement shown in Fig. 2 is similar to that shown in Fig. 1, except that the portion of the track corresponding to section A of Fig. 1 is divided into two sections A and B, and another relay 2′ is employed, having its armature winding connected across the rails of section B and its field coil supplied by a secondary t^3 of a transformer T′. The contact arm 2^d of this relay is shown as having both back and front contacts.

The operation of a passing train is as follows:—When the train enters section A, home signal 4 is put at danger as above described. As the train enters section B, the relay 2′ is deënergized thereby cutting off the supply of current from th section A. The contact arm 2^d in falling against its back contact forms a shunt for the section A against any possibility of current reaching said section from the adjacent track circuit. This back contact feature may, however, be omitted, as it is merely an added precaution. As the train enters the section C, the armature of the three-position relay 3 assumes its middle, or open-contact position, which puts the distant signal 5 to caution and cuts off the supply of current to section B. The home signal 4 remains at danger. As the train enters the section D, home signal 6 is put to danger, and the pole changer P is shifted, thus reversing the current in section C and in the armature of relay 3. This relay is now actuated as in the form first described, to continue the interruption of current to the distant signal 5, but to close the supply of current to track section B. Relay 2′ is now again energized, and thereby supplies current to the track section A and clears the home signal 4. As the train passes out of the block D, home signal 6 is thereby cleared, which again actuates the pole changer P and reverses the relay 3. The latter now closes the controlling circuit of the distant signal 5 and clears it, and also closes to section B the supply of current. The momentary interruption of current by another contact while the relay 3 is shifting may cause the relay 2′ to momentarily open and thus momentarily interrupt the current in section A. The relay S will, however, act in the manner before described to prevent the opening of the circuit of the home signal 4.

In the arrangement shown in Fig. 3, the home and distant signals are both placed at the entrance to the block and a relay 3′ which is similar to the relays 3 of the other two forms has its armature connected across the track section A, and its field supplied by the secondary of a transformer T^3, (the track having its sections similar to Fig. 1). A relay 3^2, similar to the relays 3 has its armature connected across the rails of the section B and both contact arms 3^e and 3^f of this relay have front and back contacts, arranged to reverse the current flowing from one secondary of the transformer T^4 to the track section A. The other secondary of the transformer T^4 is in series with the field winding of the relay 3^2.

The home and distant signals 4 and 5 having their actuators connected in parallel with the secondary of the transformer T^3, the circuit branch which supplies the distant signal being carried through the contacts controlled by the relay arm 3^g, while the branch which supplies the home signal actuator is carried through the contact of the vane relay S.

whose winding is completed through the relay contact arm 3^h. In this figure, as well as in Fig. 2, corresponding parts have been given the same reference characters as in Fig. 1, in order to avoid confusion, and different reference characters have been employed to distinguish parts not present or having a different function.

The operation of the arrangement shown in Fig. 3 is as follows:—When the train enters section A, all contacts of the relay 3′ and S are opened and both signals 4 and 5 go to danger. When the train enters section B, relay 3^2 also assumes its intermediate or open contact position, so that current is cut off from the section A and the signals 4 and 5 remain at danger. When the train enters section D, the home and distant signals 6 and 6^a go to danger, and the pole-changer P is shifted to reverse the current supply to the section B. This reverses the relay 3^2, which assumes its other circuit closing position and reverses the direction of current supplied to the track section A. Relay 3′ is therefore actuated in the reverse direction to close its other set of contacts. This retains open the circuit of the distant signal 5, but closes the circuit of home signal 4 by way of slow-release relay S, and this signal goes to clear position. When the train advances beyond section D, home signal 6 clears, and shifts the pole changer P. This reverses the operation of relay 3^2, and thereby of relay 3′. This closes the circuit of distant signal 5, which now clears, home signal 4 being held at clear by the slow-release relay S.

The advantages of my invention will be apparent to those skilled in the art, since it eliminates the line wires for the distant signals, while at the same time the home signals are held at clear while the distant signal controlling relays are shifting, by means of the slow release relays.

Many changes may be made in my invention. Thus the several different types of relays may be of any known character suitable for the purpose. These relays may assume their open-circuit positions either by gravity or by the action of a spring.

Various forms of pole changers may be used, and the circuits can be changed in many ways, so long as the principles of my invention as defined in the appended claims are retained.

What I claim is:—

1. In an alternating current block-signaling system, home and distant signals, sectional track circuits for said signals, relays controlled by the track circuits for controlling the home signals, other relays which control the supply of current to the home-signal controlling circuits, and means controlled by the movements of the home signals for reversing the polarity of the last named relays; substantially as described.

2. In an alternating current block-signaling system, home and distant signals, sectional track circuits for said signals, relays controlled by the track circuits for controlling the home signals, other relays which control the supply of current to the home-signal controlling circuits, and means controlled by the movements of the home signals for reversing the polarity of the last named relays, such relays being connected across track sections which are independent of the sections to which the home-signal controlling relays are connected; substantially as described.

3. In an alternating current block signaling system home signals, controlling circuits and actuating devices therefor controlled by the passage of trains into and out of the blocks, distant signals, controlling circuits therefor which are connected to different sections of the track than those to which the controlling circuits for the home signals are connected, reversing relays for controlling the current-supply to the track sections to which the circuits of the distant signals are connected, and pole-changing means operated by the home signals for effecting the reversals of the said relays; substantially as described.

4. In an alternating current block signaling system home signals, controlling circuits and actuating devices therefor controlled by the passage of trains into and out of the blocks, distant signals, controlling circuits therefor which are connected to different sections of the track than those to which the controlling circuits for the home signals are connected, reversing relays for controlling the current supply to the track sections to which the circuits of the distant signals are connected, and pole-changing means operated by the home signals for effecting the reversals of the said relays, together with means for preventing the opening of the home signal circuits while the said relays are reversing; substantially as described.

5. In an alternating current block signaling system, home signals, controlling circuits and actuating devices therefor controlled by the passage of trains into and out of the blocks, distant signals, controlling circuits therefor which are connected to different sections of the track than those to which the controlling circuits for the home signals are connected, reversing relays for controlling the current-supply to the track sections to which the circuits of the distant signals are connected, and pole-changing means operated by the home signals for effecting the reversals of the said relays, together with slow-motion relays in the home signal circuits for preventing the opening of such circuits while the said relays are reversing; substantially as described.

6. In a block-signaling system of the char-

acter described, a sub-divided track circuit, home signal controlling relays connected across the rails of some of the track circuits, distant signal controlling relays connected across the rails of different track sections, and having an open circuit position, a position in which the proper home signal circuit is maintained closed while the distant signal circuit is open, and a third position in which both said circuits are closed, and pole changing means operated by a home signal in advance for effecting a reversal of the said relays; substantially as described.

7. In a block-signaling system of the character described, a sub-divided track circuit, home signal controlling relays connected across the rails of some of the track circuits, distant signal controlling relays connected across the rails of different track sections, and having an open circuit position, a position in which the proper home signal circuit is maintained closed while the distant signal circuit is open, and a third position in which both said circuits are closed, and pole changing means operated by a home signal in advance for effecting a reversal of the said relays, together with auxiliary relays for preventing the home signal circuits from opening while the corresponding distant signal relays are reversing; substantially as described.

8. In a block-signaling system of the character described, a distant signal controlling relay of the reversing type, having one of its windings connected across the rails of an insulated track section, and controlling the supply of current to the next preceding insulated track section, a home signal having a controlling relay controlled by the last named track section, said reversing relay having one position in which current is supplied to the preceding track section and also to the distant signal actuator, another position in which both these circuits are opened, and a third position in which the supply circuit for the preceding track section is closed, but the distant signal actuator circuit is open, and means controlled by the home signal for shifting said relay from the first to the third positions and reversely; substantially as described.

9. In an alternating current signaling system, a sub-divided track circuit, a distant signal controlling relay having a winding connected across the track rails of one section and arranged to be short circuited by the presence of a train in said section, to thereby open all the circuits which it controls, a home signal having a controlling relay connected across the preceding track section and having its current supply controlled by the reversing relay, and means controlled by a second home signal for reversing said relay to control the supply of current to the preceding track section and also to the distant signal actuator; substantially as described.

10. In an alternating current signaling system, a sub-divided track circuit, a distant signal controlling relay having a winding connected across the track rails of one section and arranged to be short circuited by the presence of a train in said section, to thereby open all the circuits which it controls, a home signal having a controlling relay connected across the preceding track section and having its current supply controlled by the reversing relay, and means controlled by a second home signal for reversing said relay to control the supply of current to the preceding track section and also to the distant signal actuator, together with means for preventing the first named home signal from going to danger while the said relay is reversing; substantially as described.

11. An alternating current block-signaling system, having its blocks subdivided, a relay controlling the home signal for each block, and connected across the rails of one of the block divisions, a second relay connected across the rails of the adjacent block division and controlling the supply of signaling current for the home signal controlling relay, means for controlling the second relay, a distant signal, and means controlled by the second relay for controlling the distant signal; substantially as described.

In testimony whereof, I have hereunto set my hand.

JACOB B. STRUBLE.

Witnesses:
D. J. McCarthy,
Jno. D. Taylor.