No. 793,245. PATENTED JUNE 27, 1905.

H. B. TAYLOR.

AUTOMATIC BLOCK SIGNALING SYSTEM.

APPLICATION FILED DEC. 17, 1904.

2 SHEETS—SHEET 1.

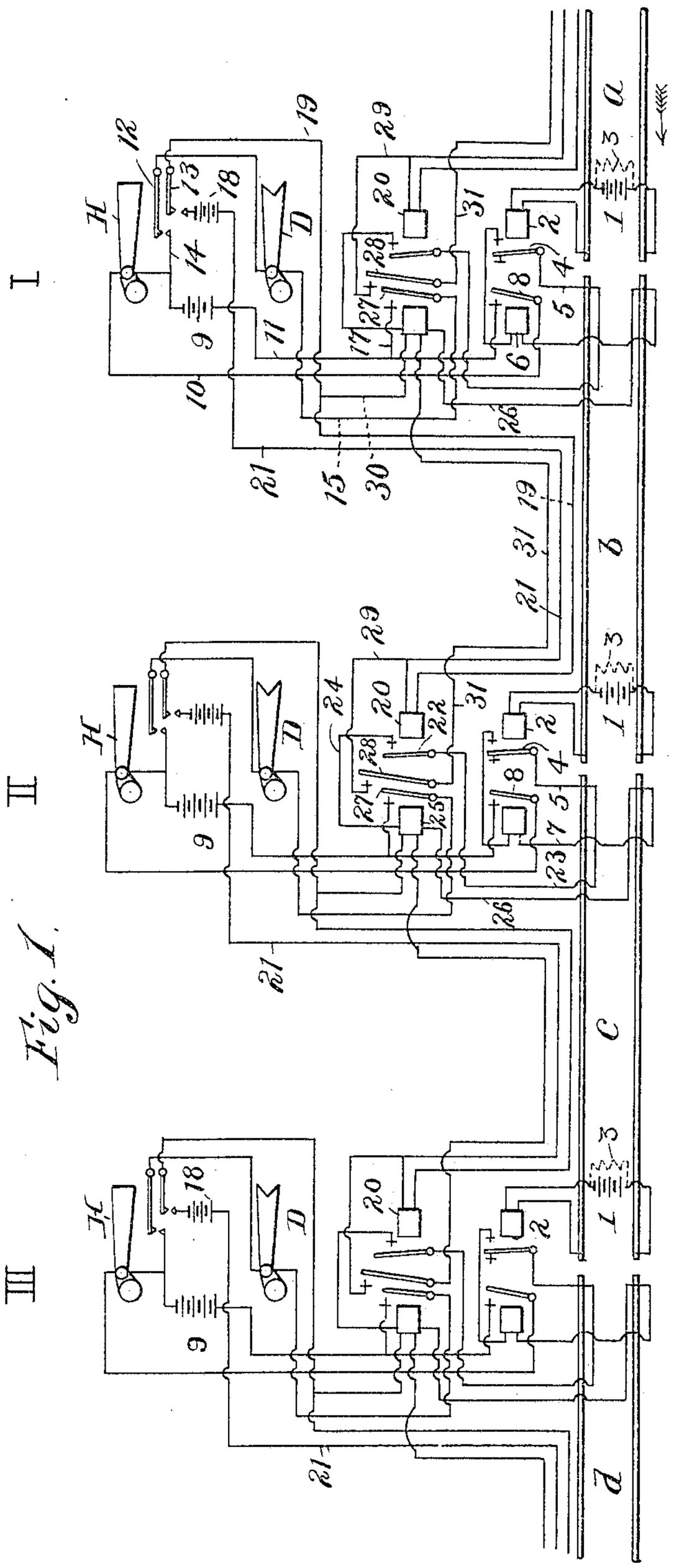

Fig. 1.

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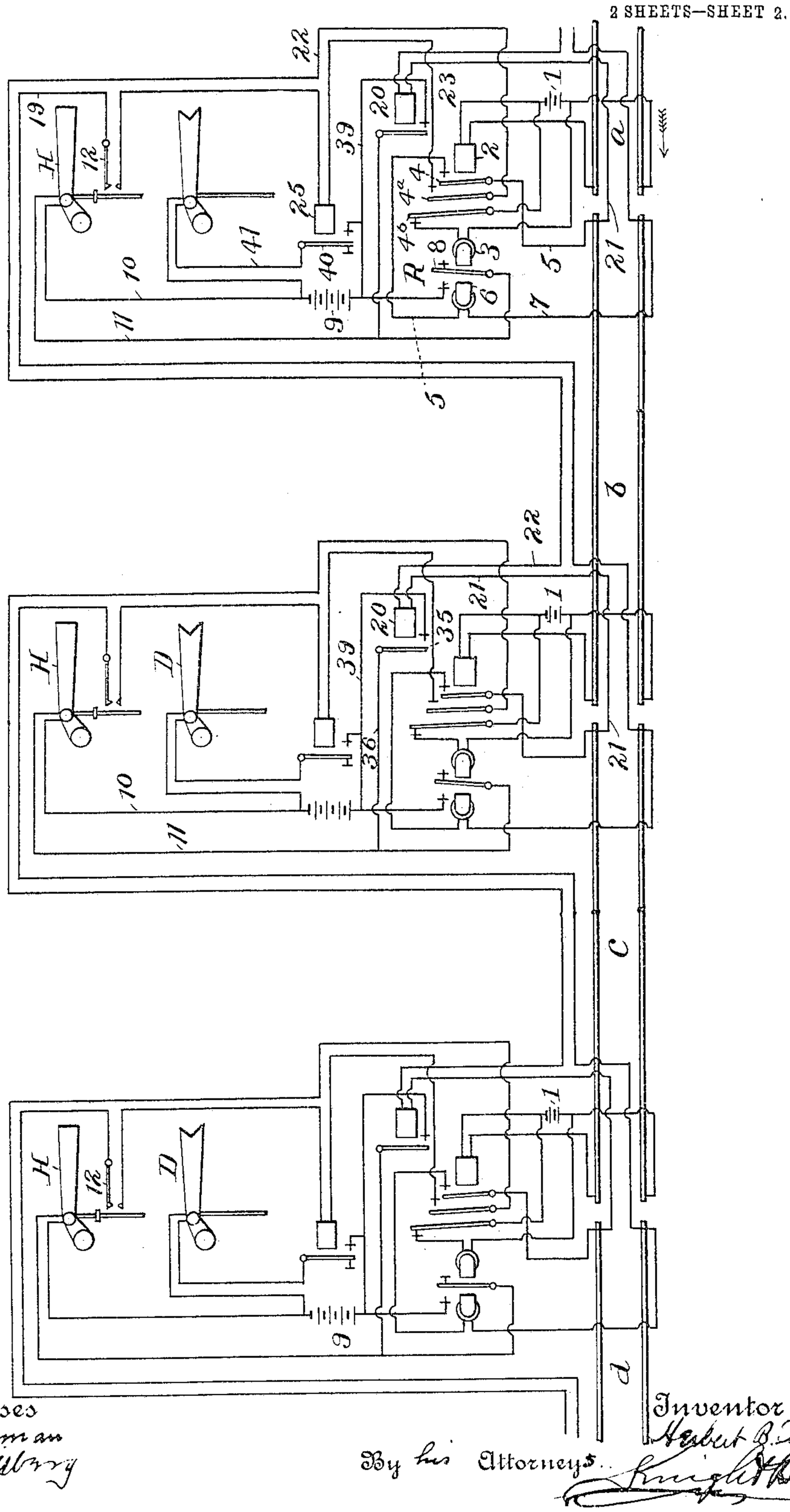

Fig. 2.

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No. 793,245. Patented June 27, 1905.

UNITED STATES PATENT OFFICE.

HERBERT B. TAYLOR, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO ADVANCE SIGNAL CO., OF NEWARK, NEW JERSEY, A CORPORATION OF NEW JERSEY.

AUTOMATIC BLOCK-SIGNALING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 793,245, dated June 27, 1905.

Application filed December 17, 1904. Serial No. 237,264.

To all whom it may concern:

Be it known that I, HERBERT B. TAYLOR, a citizen of the United States, residing in East Orange, county of Essex, and State of New Jersey, have invented certain new and useful Improvements in Electric Block-Signaling Systems; and in order that those skilled in the art may make, construct, use, and understand the same I give the following specification.

This invention relates to improvements in automatic electric block-signaling systems the signals of which are controlled by the presence or absence of a train upon a block, the rails of a block forming part of an electric circuit controlling the operation of the signals.

This invention is designed to operate as a normal danger system, in which all signals have a normal danger position and require that the circuits through the rails shall be unbroken in order that the presence of a train on a block shall control signals for advance blocks to cause them to be shifted to safety position. If the rail-circuits of advance blocks be interrupted through accident, such as a broken or displaced rail, or be short-circuited by the presence of a car, train, or other obstruction on the track, the signals for those blocks will remain in their normal danger position and will not be operated.

The present invention is in the nature of an improvement upon that set forth in my application, Serial No. 31,643, filed October 1, 1900, and has for its object to provide a system of the character described, including both home and distant signals, so that the engineer may be warned of the condition of the track at least two blocks in advance of any given signal.

In order that my invention may be clearly understood, I have illustrated the same in the accompanying drawings, Figure 1 of which illustrates diagrammatically one form of my invention, and Fig. 2 illustrates a modification thereof.

Similar reference characters are used in each figure of the drawings to indicate corresponding features as far as the nature of the invention will permit.

A portion of a track equipped with my invention is shown in the drawings, the track being divided into a number of blocks, (indicated by the letters *a*, *b*, *c*, and *d*.) The rails of these blocks form a consecutive number of normally open rail-circuits electrically separate one from the other, as indicated by the gaps between the ends of the rails and adjacent blocks. These blocks may be of any desired length compatible with the practical working of the system and the nature of the road. Signals (indicated by the reference-letters H and D) are located in position to indicate the condition of advance blocks. For convenience of reference the locations or stations of these signals are indicated by the numerals I, II, and III. Referring to Fig. 1, each block is provided with a track-battery 1, connected across the rails of the block and including in its circuit a relay 2 of relatively low resistance, connected to the rails near the entrance end of the block. The circuit of the track-battery also includes a circuit-closer 4, arranged to be operated by the relay 2 of the block next in rear. This circuit-closer 4 is included in a circuit 5 from one rail of its block through a relay 6 of relatively high resistance to the other rail of the block through a connection 7. Relay 6 operates a circuit-closer 8, included in the circuit of a signal-operating battery 9, said battery-circuit leading from the battery 9 through the signal H, connection 10, circuit-closer 8, connection 11, back to the battery. The signal H is a home signal to indicate the condition of the block *b* immediately in advance thereof and normally stands at danger position. The closing of the circuit of the signal-battery 9 causes its signal H to be shifted to safety position, provided the condition of the home block *b* in advance be clear and its rail-circuit unbroken. Suitably connected to the signal H, so as to move therewith, are two circuit-closers 12 and 13. Circuit-closer 12 is included in a connection 14, leading

from the signal-operating battery through signal D, connection 15, circuit-closer 27, tap 17 to connection 11, and back to the signal-battery 9. Signal D is thus operated from the same battery as signal H, provided this circuit be closed through the circuit-closer 27. Circuit-closer 13 is included in a circuit from an auxiliary battery 18, connection 19, a relay 20, (situated at the station II in advance,) connection 21, back to battery 18. Relay 20 of the station in advance operates a circuit-closer 22, which controls a circuit leading from the upper rail of a distant block *c*, through connection 23, circuit-closer 22, connection 24, one winding of relay 25, connection 26, to the lower rail of block *c*. Relay 25 is thus included in the circuit of track-battery 1 of distant block *c*. Relay 25 operates a circuit-closer having two tongues 27 and 28. Tongue 28 (at station II) controls a circuit through connection 29, connection 21, auxiliary battery 18, (at station I,) circuit-closer 13, connection 19, connection 30, a second winding of relay 25, (at station I,) connection 31, back to circuit-closer 28, (at station II.) Relay 25 at station I is thus energized, and its circuit-closer 27 closes the circuit of the distant signal D at station I through the tap 17, connection 11, battery 9, connection 14, circuit-closer 12, signal D, connection 15. Signal D at station I is then operated, provided the conditions on the track are such as to close the circuits described.

The operation of the system as above described is as follows: The track-batteries 1 are preferably maintained on closed circuit through a high-resistance shunt 3, (shown in dotted lines in Fig. 1,) though they may of course be on open circuit, if desired. The use of this shunt will depend on the type of battery preferred. If a train enter block *a*, traveling in the direction of the arrow, the wheels and axles of the same bridge the rails of the block, causing low-resistance relay 2 at station I to be energized. Upon energizing of this relay circuit-closer 4 is operated to close the circuit of relay 6, connected to the entrance ends of the rails of block *b*. Relay 6 thereupon becomes energized from the track-battery 1 of block *b* and operates circuit-closer 8. As compared with relay 2 of its block relay 6 is of relatively high resistance, so that relay 2 of block *b* does not become energized sufficiently to operate its circuit-closer. Relay 6 being energized closes the signal-circuit of home signal H at station I, provided the block *b* be clear and its rail-circuit unbroken. Home signal H thereupon moves from its normal-danger position to a position indicating "safety" for block *b*. Upon the shifting of signal H to "safety" circuit-closers 12 and 13 close their respective circuits. Circuit-closer 13 closes the circuit of relay 20 at station II, which thereupon becomes energized from auxiliary battery 18 at station I in this circuit and operates circuit-closer 22. Circuit-closer 22 closes a circuit in which is included the relay 25 and the rails and battery of distant block *c*. This relay 25 is wound to about the same resistance as relay 6, so that upon energizing of this relay from battery 1 of block *c* relay 2 of said block will not receive current sufficient to operate its circuit-closer 4. The energizing of relay 25 operates circuit-closers 27 and 28. Circuit-closer 28 closes the circuit of relay 25 at station I. This relay being connected in the circuit of auxiliary battery 18 at station I becomes energized and closes the circuit of distant signal D through the tap 17, connection 11, battery 9, connection 14, circuit-closer 12, signal D, connection 15, and circuit-closer 27. Signal D thereupon is operated and moves to safety position, provided the distant block *c* is clear and its rail-circuit be unbroken. It will thus be seen that a train entering upon a block causes the operation of both home and distant signals, indicating the condition of two blocks in advance.

It will be seen that according to the system illustrated and described only the signals of the station in advance are operated by a train entering a block that the home signal H at station II is not operated to correspond with the distant signal D at station I while the train is on block *a*. According to some systems of signal practice it is preferred to have the home signal of a distant block operated at the same time and to correspond with the operation of the distant signal of a home block. This may be accomplished by the same circuits just described with slight modifications. I prefer, however, to employ the modification shown in Fig. 2, which embodies the same principles of invention illustrated in Fig. 1. In Fig. 2 the several blocks are indicated by the letters *a*, *b*, *c*, and *d*, as before. Each block is provided with a track-battery 1, connected across the rails near the advance end of the block and including in its circuit relay 2 of relatively low resistance. Instead of maintaining the battery 1 upon closed circuit through a high-resistance shunt I have shown in this modification the battery maintained on closed circuit through high-resistance coil 3 of a polarized or differential relay R, similar to the relay described in my application above referred to. Relay 2 is wound to relatively low resistance and operates a circuit-closer having three tongues 4, 4^a, and 4^b. Tongue 4 is included in a connection 5, leading from the entrance end of the upper rail of the block *b* in advance and through the low-resistance coil 6 of the relay R and connection 7 to the rear end of lower rail of the block *b* in advance. It is to be understood that this low-resistance coil 6 is of relatively high resistance as compared with re-

lay 2 of the same section, so that relay 2 will not be sufficiently energized to operate its circuit-closer when its circuit is closed through coil 6. Upon relay 2 becoming energized it operates its three-tongued circuit-closer and tongue 4^b moves to open the circuit of battery 1 through the high-resistance coil 3 of relay R. Coil 6 is then energized from track-battery 1, connected to the advance end of the block *b* in advance, and this coil will operate circuit-closer 8 to close the circuit of signal-operating battery 9, said circuit leading from the battery 9 through connection 10, home signal H at station I, connection 11, through circuit-closer 8, back to the battery. Signal H in moving from its normal danger position to the clear position operates a circuit-closer 12 in a similar manner as in the system before described. Circuit-closer 12 is included in a branch 19, connected to the entrance end of the lower rail of a distant block *c*. The other branch of said circuit leads from the entrance end of the upper rail of said distant block through the branch 21, relay 20 at station II, branch 22, circuit-closer 4^a at station I, branch 23, relay 25 at station I, back to the break of circuit-closer 12. Relay 20 of one block and relay 25 at a rearward station are thus in series in the same circuit. They are wound to have equal ohmic resistances, and their combined resistance is equal to the resistance of coil 6 of relay R, so that when this circuit is energized by track-battery 1 of the distant block relay 2 of that block will not be sufficiently energized to operate its circuit-closer 4. Relay 20 at station II upon becoming energized operates a circuit-closer 35, included in a circuit 36 11, home signal H at station II, connection 10, signal-operating battery 9, connection 39, to the break of said circuit-closer. Thereupon said signal H at station II is operated to indicate "safety" for block *c*, provided the rail-circuit thereof be unbroken and said block be clear. Also simultaneously relay 25 at station I operates circuit-closer 40, which is included in the circuit 41 of the distant signal D at said station and signal-operating battery 9. The operation of this system will be apparent from the above description. Thus it will be seen that when a train enters block *a* relay 2, connected to the advance end thereof, will become energized, and circuit-closers 4, 4^a, and 4^b will be operated, the circuit through the high-resistance coil 3 of the differential relay being broken by movement of circuit-closer 4^b. The low-resistance coil 6 of the differential relay then operates the circuit-closer 8 to close the circuit of the signal-battery 9 at station I, provided block *b* be clear and its rail-circuit unbroken or uninterrupted. The closing of the circuit of the battery 9 causes signal H at station I to be moved to "safety." The movement of signal H at station I closes the circuit of relay 20 at station II, this circuit being already closed at the break of circuit-closer 4^a. This relay 20 closes a circuit through signal H at station II, indicating the condition of block *c*. Relay 25 at station I being also included in the circuit of relay 20 is energized and distant signal D at station I will be moved to "safety," provided that block *c* be clear and its rail-circuit unbroken or uninterrupted. It will thus be seen that a train entering block *a* will, provided that blocks *b* and *c* be clear and their circuits intact, cause the operation of home and distant signals H and D at station I and home signal H at station II.

In practically operating these systems any equivalent devices to those mentioned may be substituted. For instance, dynamos may be used where suitable in place of batteries, and alternating or direct current may be employed in the circuits. Signals may be either of the visible or audible type or both combined. The relays or equivalent electromagnetic devices may be of any suitable character, and their respective resistances will be determined by conditions under which they are intended to operate. The relays connected to the advance end of their respective blocks should be of relatively low resistance, while the different relays connected to the entrance end of said blocks should be of relatively high resistance, and their resistances should be approximately equal—that is, in the system as illustrated in Fig. 1 relay 6 and relay 25 should have about the same ohmic resistance, and in the system as illustrated in Fig. 2 the low-resistance coil of the differential magnet should be wound to approximately the same resistance as relays 20 and 25 combined, aside from the line and rail resistances, since these are operated at different times by the same battery. The resistances of the relays connected to the rearward ends of the blocks should be of such resistance as compared with the relays 2 at the advance end of the same block that relay 2 will not be sufficiently energized to attract its circuit-closer when the track-battery is connected in circuit with said relatively high resistance relays.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. A signal system, comprising a series of normally open rail-circuit blocks, normal danger home and distant signals located to indicate in advance the condition of the home and distant blocks, signal-circuits for operating said signals, electromagnetic devices connected to the rail-circuits and actuated thereby for controlling the signal-circuits.

2. A signal system comprising a series of normally open rail-circuit blocks, normal danger home and distant signals for indicating the condition of advance blocks, signal-

circuits for operating said signals, and means for operating an advance home signal and a rearward distant signal, said means controlled by an advance track-circuit.

3. A signal system, comprising a series of normally open rail-circuit blocks, normal danger home and distant signals located to indicate in advance the conditions of the home and distant blocks, signal-circuits for operating said signals, electromagnetic devices connected to the rail-circuits of the blocks for controlling the signal-circuits, the electromagnetic device of a home block controlling the home and distant signals of said block and the home signal of a distant block.

4. A signal system, comprising a series of open rail-circuit blocks, signals suitably located for indicating the condition of advance blocks, a source of energy in circuit with the signals for operating the same, two normally deënergized electrically-controlled devices connected to the rails of adjacent blocks for controlling the signal-circuits, and a source of electrical energy so connected to each block that the entrance of a train on a block will cause the normally deënergized electrical device of that block to become energized and with the normally deënergized device of an advance block to operate the signals of the advance blocks.

5. A signal system, comprising a series of normally open rail-circuit blocks, normal danger home and distant signals located to indicate the condition of advance blocks, signal-circuits for operating said signals, a normally deënergized electromagnetic device connected to the entrance end of the rails of each block for controlling the home signal of that block, and a second normally deënergized and similarly-connected electromagnetic device for each block for controlling the signal-circuit of the distant signal of said block.

6. A signaling system, comprising a series of normally open rail-circuit blocks, normal danger home and distant signals located to indicate the condition of advance blocks, signal-circuits for operating said signals, two normally deënergized electromagnetic devices connected to the entrance end of the rails of each block, one of said devices controlling the home-signal circuit of its block and the other controlling the distant signal of said block.

7. A signal system, comprising a series of normally open rail-circuit blocks, normal danger home and distant signals for indicating the condition of advance blocks, signal-circuits including a source of energy for operating said signals, a circuit controlled by the home signal of a block, said circuit connected to the rails of a distant block and controlling the signal-circuit of the distant signal of the first-mentioned block.

8. A signal system, comprising a series of normally open rail-circuit blocks, normal danger home and distant signals for indicating the condition of advance blocks, signal-circuits including a source of energy for operating said signals, a circuit controlled by the home signal of a block, said circuit connected to the rails of a distant block and controlling the home and distant signals for indicating the condition of said distant block.

9. A signal system, comprising a series of normally open rail-circuit blocks, normal danger home and distant signals located to indicate the condition of advance blocks, signal-circuits for operating said signals, a normally deënergized electrically-controlled device connected to the rails of a block and controlling the rail-circuits of two advance blocks.

10. A signal system, comprising a series of normally open rail-circuit blocks, normal danger home and distant signals located to indicate the condition of advance blocks, signal-circuits for operating said signals, a normally deënergized electrically-controlled device connected to the rails of a block, normally deënergized electrically-controlled devices connected to the rails of two blocks in advance, said devices of the two advance blocks controlled by the first-mentioned device whereby the energizing of the first-mentioned device operates to close the rail-circuits of said two advance blocks.

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