No. 825,318. PATENTED JULY 10, 1906.

L. A. HAWKINS.

BLOCK SIGNAL SYSTEM.

APPLICATION FILED JAN. 25, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

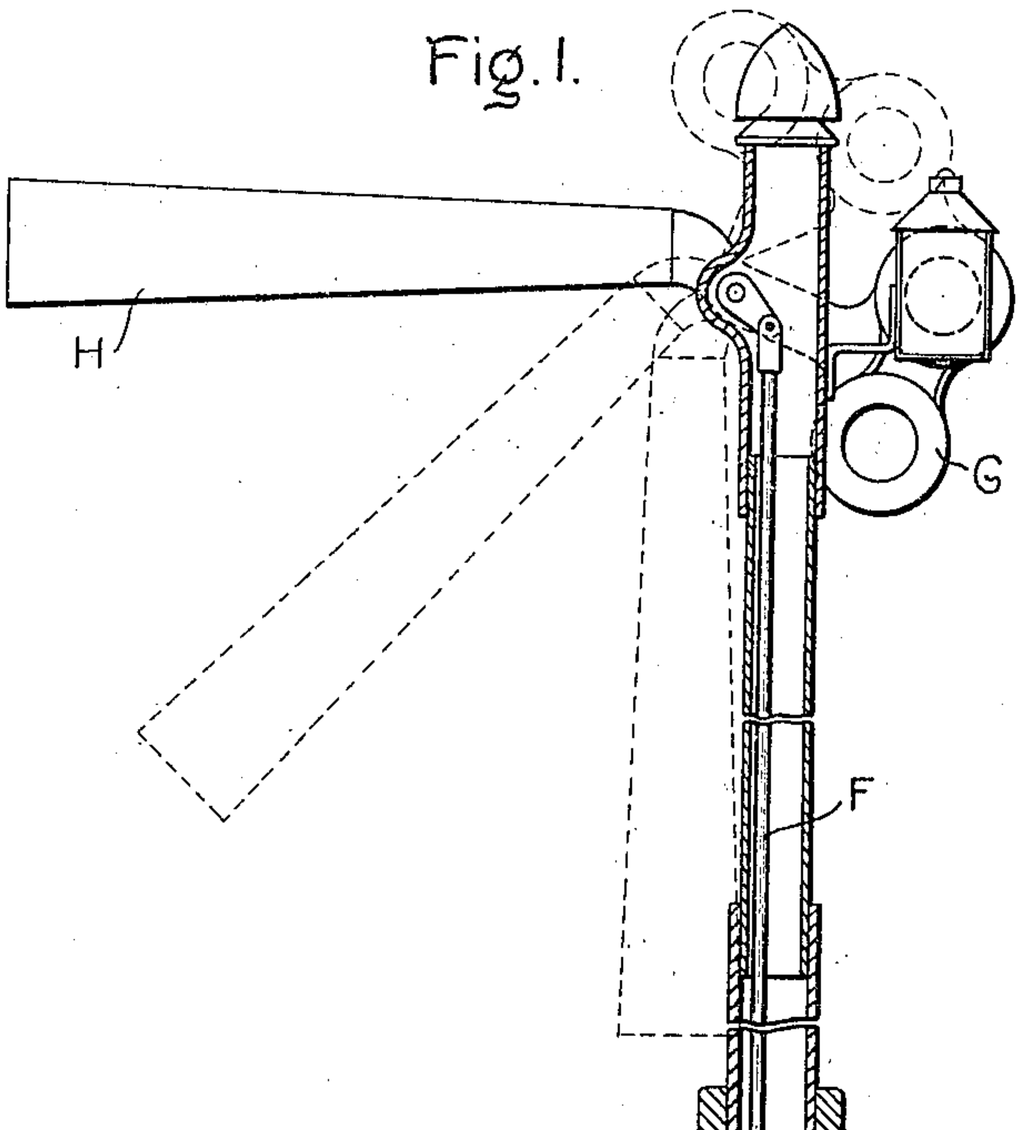


Fig. 2.

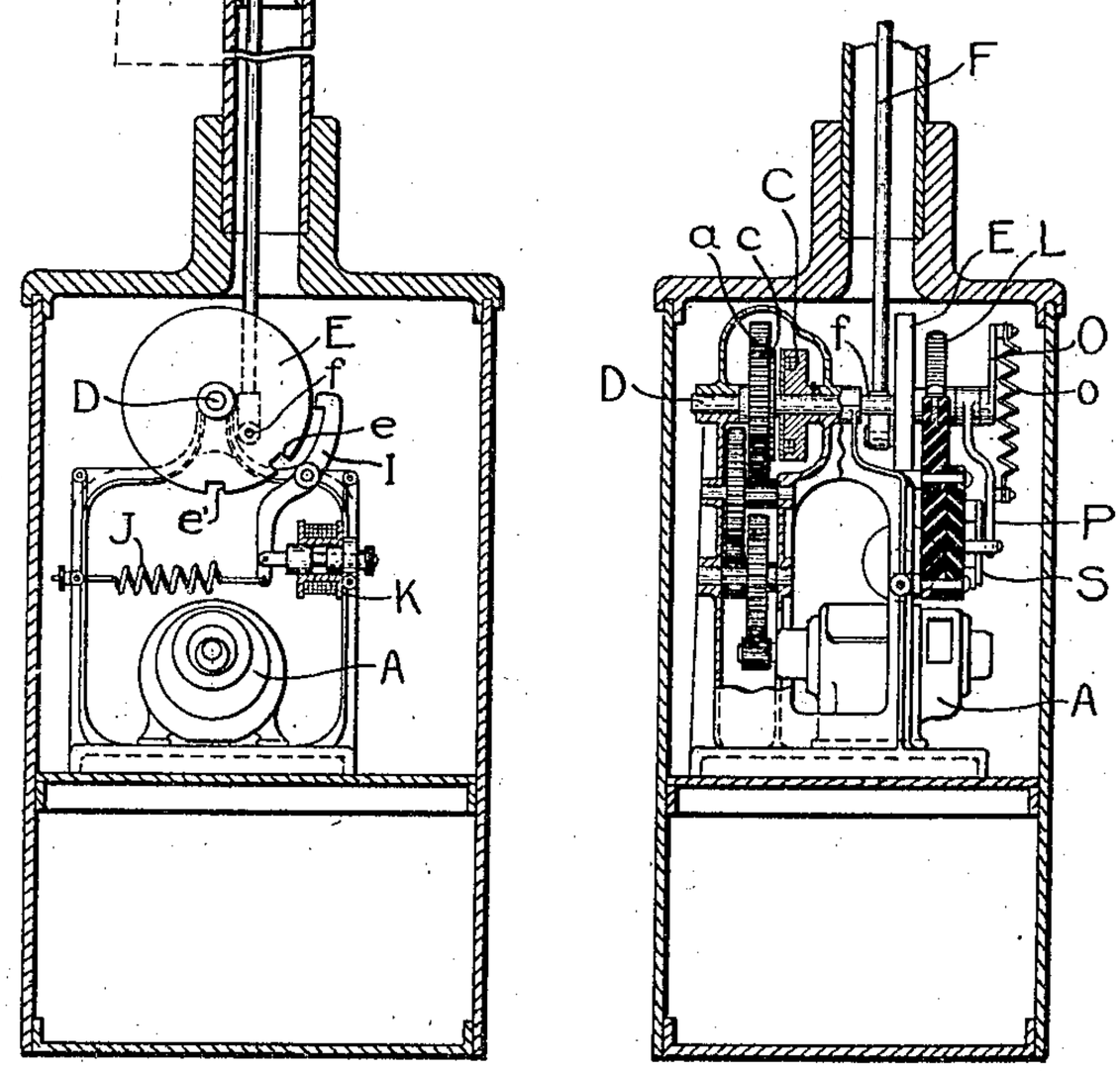


Fig. 3.

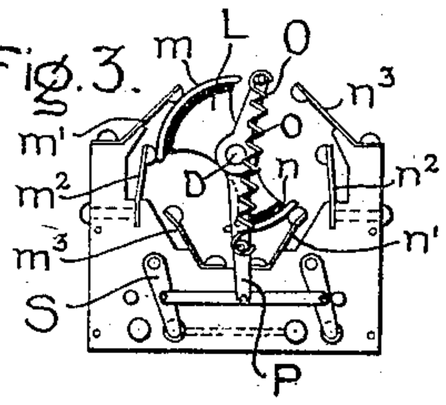


Fig. 4.

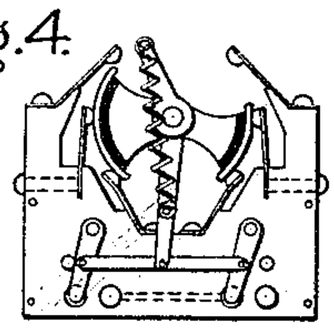
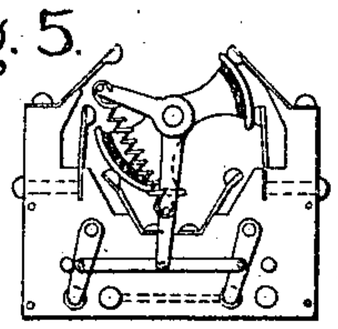


Fig. 5.



Witnesses:

Ebnathan E. Briggs.

Helen Alford

Inventor.

Laurence A. Hawkins

by Albert G. Davis

Att'y.

No. 825,318. PATENTED JULY 10, 1906.

L. A. HAWKINS.

BLOCK SIGNAL SYSTEM.

APPLICATION FILED JAN. 25, 1905.

2 SHEETS—SHEET 2.

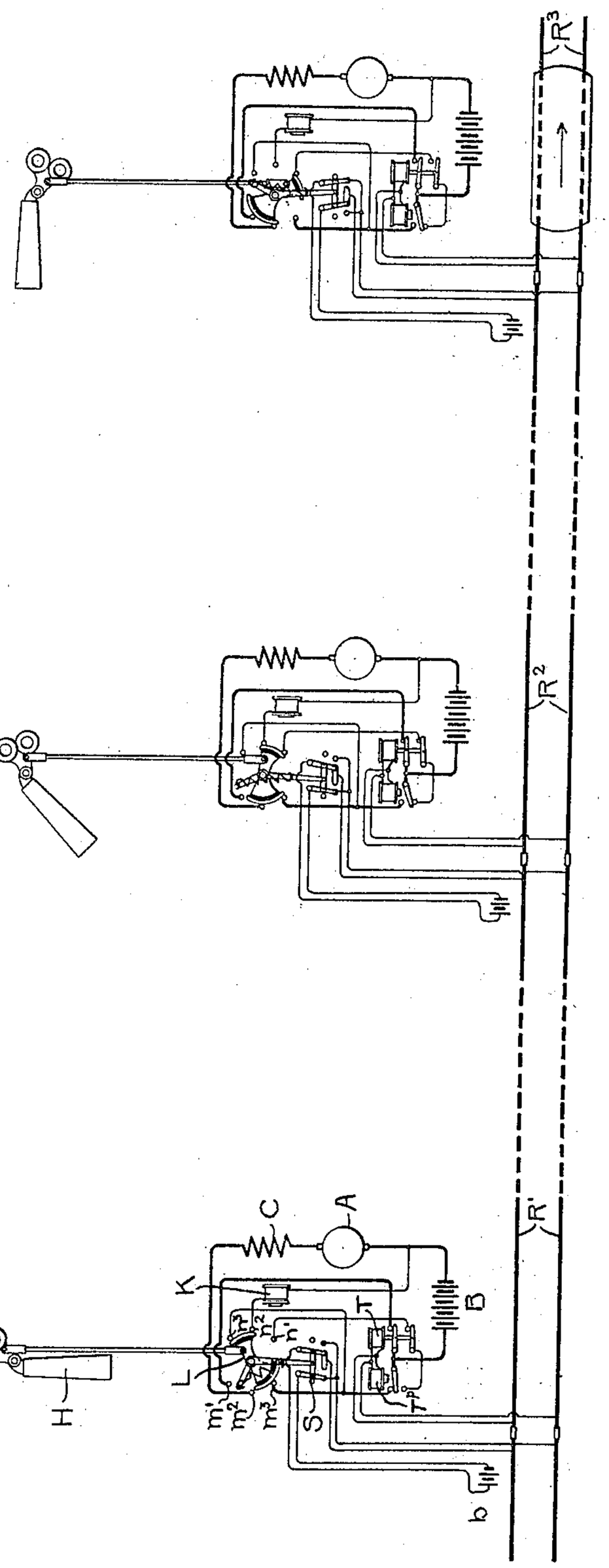


Fig. 6.

Witnesses.
Ebnathan E. Bugge
Helen Oxford

Inventor:
Laurence A. Hawkins.
by Albert G. Davis
Atty.

UNITED STATES PATENT OFFICE.

LAURENCE A. HAWKINS, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

BLOCK-SIGNAL SYSTEM.

No. 825,318. Specification of Letters Patent. Patented July 10, 1906.

Application filed January 25, 1905. Serial No. 242,622.

To all whom it may concern:

Be it known that I, LAURENCE A. HAWKINS, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Block-Signal Systems, of which the following is a specification.

My invention relates to automatic block-signals; and its object is to provide a simple and efficient system for the control of what are known as "three-position" signals without the necessity of employing any line-wires connecting the signals of successive blocks.

My invention is particularly applicable to systems employing signals operated by electric motors, though in many of its features it is not limited to signals of this type.

Where it is desired that the signals should indicate the condition both of the block at which they are posted and of the following block, two arrangements have been proposed heretofore. One of these arrangements consists in the employment of two signals at the entrance of each block, known, respectively, as "home" and "distance" signals, the home signal serving to indicate the presence of a train in the block at which it is posted and the distance signal the presence of a train in the following block. The second arrangement consists in the employment of a signal arranged to assume three distinctive positions, known as "danger," "caution," and "clear," which indicate, respectively, that a train is in the block at which the signal is posted, that a train is in the following block, and that a train is in neither. This latter arrangement has the advantage of eliminating one signal-arm at each block, and thereby reducing the complication and cost of the signal mechanism. On the other hand, the employment of separate home and distance signals has had the advantage of rendering it possible by means of a simple arrangement to do away with all line-wires between the signals at adjacent blocks. This has been accomplished by controlling the distance signal through a polarized track-relay and a reversing-switch in the track-circuit operated by the home signal of the following block. This is readily arranged, since the distance signal and the home signal of the following block always operate simultaneously. Such an arrangement, however, is not so simple when three-position signals are employed, since there is then only one signal at the entrance of each block, which performs the functions of both home and distance signals and which must sometimes move simultaneously with the signal of the following or of the preceding block and at other times independently thereof. By my invention it is possible to do away with these line-wires and to operate three-position signals by means of a polarized relay with as simple arrangement and as efficiently as though independent home and distance signals were employed.

In one aspect my invention consists in the combination of a three-position signal and the operating mechanism therefor, of a switch actuated by the signal mechanism, two relays, one polarized and one non-polarized, controlling jointly with said switch the circuits for the operating mechanism for the signal, and a reversing-switch controlling the connections from the source of current for the preceding block to the track-circuit of that block and arranged to be operated while the signal is moved from danger to caution position.

More specifically stated, my invention in this aspect consists in the above combination, the relays having their contacts so arranged that when both relays are deënergized the circuit of the operating mechanism is open. When the non-polarized relay is energized, the circuit of the operating mechanism is closed if the signal is in danger or between danger and caution positions, and when the polarized relay is energized the circuit is closed when the signal is at caution or between caution and clear positions.

In the control of three-position signals it has been customary heretofore to provide a switch controlled by the signal mechanism to break the circuit of the operating mechanism when the signal reaches its desired position and to energize a lock magnet or magnets for holding the signal in position. My invention further consists in the combination of such a switch operated by the signal mechanism and a lock-magnet of a polarized and a non-polarized relay controlling the circuit of said locking-magnet in conjunction with said switch, the contacts of the relays being so arranged that when both relays are deënergized the lock-circuit is open regardless of the position of the switch. When the non-polarized

relay is energized and the polarized relay is deënergized, the circuit of the lock-magnet is closed when the signal is at caution position, and when both relays are energized the circuit of the lock-magnet is closed when the signal is at clear position. Other features of my invention will appear from the following specification and will be more specifically pointed out in the appended claims.

My invention will best be understood by reference to the accompanying drawings, in which—

Figure 1 shows a front elevation of a three-position signal adapted for use in a system arranged in accordance with my invention. Fig. 2 shows a side elevation of the actuating mechanism therefor. Figs. 3, 4, and 5 are detailed views showing the main signal-actuated switch and the reversing-switch in the positions they occupy for danger, caution, and clear positions of the signal mechanism; and Fig. 6 is a diagram showing the circuit connections arranged in accordance with my system.

Although I have illustrated and shall herein describe a three-position signal adapted for use in a system arranged in accordance with my invention, it will be understood that my invention is in no way limited to this specific type of signal, but may be employed with other forms of three-position signals well known in the art.

In Figs. 1 and 2, A represents an electric motor connected through a speed-reducing train of gears to the gear *a*, which is loosely mounted on the main driving-shaft D. The gear *a* carries the armature *c* of an electromagnetic clutch C, which is fast to the drive-shaft D. When clutch C is energized, the motor A drives the drive-shaft D through the speed-reducing gears, but when the clutch C is deënergized motor A and drive-shaft D are free to rotate independently of each other. On drive-shaft D is a disk E, which carries a stud *f*, on which is pivotally mounted one end of the connecting-rod F, the upper end of which is connected to the spectacle-casting G, which carries and acts as a counterweight for the semaphore-blade H. The casting G is of sufficient weight so that when the drive-shaft D is free to revolve the casting G will move the signal-arm H into the danger position, as shown in Fig. 1. The positions of the signal-arm and casting for caution and clear positions are indicated in dotted lines.

The disk E is provided with two notches *e* and *e'*, as shown in Fig. 1. These notches are adapted to be engaged by the pivoted lever I when the signal is in caution and clear positions, respectively. The lever I is held out of engagement with the disk E by tension-spring J and is drawn into engagement with the disk by the magnet K. When the signal is at caution or clear position and the lock-magnet K is energized, the signal is locked in position, and when magnet K is deënergized the signal is released. The driving-shaft D also carries the switch member L, which is clearly shown in Figs. 3, 4, and 5. This switch member L carries two movable contacts *m* and *n*, which are adapted to engage the stationary contacts *m'* to m^3 and *n'* to n^3, respectively. It will be seen that with the switch member L in the position which it occupies when the signal is at danger position, as shown in Fig. 3, contact *m* bridges contacts *m'* and m^2. In caution position, as shown in Fig. 4, contact *m* has left contact *m'* and bridges contacts m^2 and m^3, while contact *n* bridges contacts *n'* and n^2. In clear position, as shown in Fig. 5, contact *m* has left contact m^2, while contact *n* bridges contacts n^2 and n^3. Also rigidly secured to the drive-shaft D is the arm O, to which is secured one end of the tension-spring *o*. The other end of the tension-spring *o* is secured to an arm P, which is loosely mounted on shaft D and the outer end of which engages and operates the reversing-switch S. It will be seen from Figs. 3, 4, and 5 that as the signal moves from danger to caution position arm P and switch S will not be moved until the movement of arm O has carried tension-spring *o* past the center of drive-shaft D. Switch S will then be quickly shifted to its opposite position, as shown in Fig. 4. The spring connection between the arms O and P is for the purpose of making switch S act as a snap-switch. No movement of switch S is produced by the movement of the signal from "caution" to "clear," but the switch snaps from one position to the other while the signal is moving from "danger" to "caution" or from "caution" to "danger."

Referring now to Fig. 6, the connections and operation of the system will be explained. R', R^2, and R^3 represent the rails of three blocks, which will be hereinafter called the "first," "second," and "third" blocks, respectively. The third block is shown occupied by a train or car which is supposed to be going in the direction indicated by the arrow. The signal H of the third block is consequently at danger position, and the signals of the second and first blocks are at "caution" and "clear," respectively. The several portions of the operating mechanisms for the signals are lettered the same for each block. A represents the motor, and C the clutch-coil, heretofore described, and L the main switch actuated by the signal mechanism. B represents a suitable source of current for motor A and clutch-coil C, such as a battery. K represents the locking-magnet for locking the signal at clear and caution positions, as heretofore explained. The circuit of the motor and clutch is shown in heavy lines and the circuit of the lock-magnet in light lines. It will be seen that the motor-circuit includes not only the switch L,

but also contacts controlled by two track-relays T and T^p. The relay T is a non-polarized relay, while the relay T^p is polarized. Both relays are connected in parallel to one end of the track-circuit of the block, while to the other end of the block is connected a suitable source of current, such as a battery *b*, through a reversing-switch S, actuated by the signal of the following block.

The operation is as follows: When the train leaves the third block, the non-polarized relay T of the third block will be energized; but the polarized relay T^p will not be energized, since the signal of the following block will have gone to "danger" and the reversing-switch controlled by that signal will have assumed the same position as the reversing-switch S in the third block, which is the position for sending a current from the battery *b* through the block in such a direction that the polarized relay is not energized. The energizing of the non-polarized relay T closes the motor-circuit as follows: from the left-hand end of battery B through the upper armature controlled by relay T, through contact m', contact m, contact m^2, clutch-coil C, motor A, to the right-hand end of battery B. The motor and clutch are thus both energized and the motor will begin to drive the signal from danger to caution position. When caution position is reached, contact m will leave contact m' and contact n will engage contact m^2, as shown in Fig. 4. The motor-circuit is thereby broken, while a circuit is closed through lock-magnet K, as follows: from the left-hand end of battery B through the armature of relay T^p, through the lower armature of relay T, contact n', contact n, contact n^2, lock-magnet K, right-hand terminal of battery B. The signal of block 3 will thus be locked in caution position. When or before this posision is reached, the reversing-switch S will have snapped over to its opposite position in the manner heretofore explained. The position and connections of all parts of the operating mechanism of block 3 will then be the same as is shown for block 2. Meanwhile the shifting of the reversing-switch S of block 3 has produced the following changes at block 2: The reversal of the connections of battery *b* to the track-circuit of block 2 has energized the polarized relay T^p of block 2, with the following results: The circuit of lock-magnet K is broken by the armature of relay T^p, leaving its back contact and the motor-circuits closed from the left-hand terminal of battery B through the armature of T^p, contact m^3, contact m, contact m^2, clutch-coil C, motor A, to right-hand terminal of battery B. The motor consequently begins to drive the signal H from caution to clear position. When clear position is reached, contact m leaves contact m^2, thereby breaking the motor-circuit, while contact n engages contact n^3 and closes a circuit as follows: from left-hand terminal of battery B through the armature of relay T^p, contact n^3, contact n, contact n^2, locking-magnet K, to right-hand terminal of battery B. The positions and connections of the several parts are thus the same as is illustrated in the figure for block 1. When the train passes out of the block beyond block 3, the signal at block 3 will also be driven from "caution" to "clear" in the manner that has just been explained. All three signals will then be at clear position and will remain so until another train enters block 1. When this occurs, both relays T and T^p will be deënergized and the circuit of lock-magnet K will be opened by the armature of relay T^p. The signal will consequently be allowed to go to danger position, driven by the weight of the spectacle-casting.

Although I have shown two separate relays, one polarized and the other non-polarized, it is evident that a single relay of the type disclosed in my former application, Serial No. 217,212, filed by me July 19, 1904, may take the place of these two relays.

Other forms of three-position signals may be substituted for that illustrated and described and various other changes may be made without departing from the spirit of my invention.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a block-signal system, a counter-weighted three-position signal, operating mechanism for driving said signal from "danger" to "caution" and "clear," a switch operated by said driving mechanism, means connected to the track-circuit and responsive both to current-flow and to reversal in said circuit and conjointly with said switch controlling said operating mechanism, and switch-contacts operated by said signal-operating mechanism and controlling the direction of current-flow in the preceding block.

2. In a block-signal system, a counter-weighted three-position signal, operating mechanism for driving said signal from "danger" to "caution" and "clear," a switch operated by said driving mechanism, means connected to the track-circuit and responsive both to current-flow and to reversal in said circuit and conjointly with said switch controlling said operating mechanism, and switch-contacts operated by said mechanism and arranged to reverse the direction of current-flow in the preceding block while said signal is moving from "danger" to "caution."

3. In a block-signal system, a counter-weighted three-position signal, operating mechanism for driving said signal from "danger" to "caution" and "clear," a switch operated by said driving mechanism, means connected to the track-circuit and responsive both to current-flow and to reversal in said

circuit and conjointly with said switch controlling said operating mechanism, and a snap-switch operated by said mechanism and arranged to reverse the direction of current-flow in the preceding block while said signal is moving from "danger" to "caution."

4. In a block-signal system, a counterweighted three-position signal, operating mechanism for driving said signal from "danger" to "caution" and "clear," a switch operated by said driving mechanism, two track-relays, one polarized and one non-polarized, conjointly with said switch controlling said operating mechanism, and switch-contacts operated by said mechanism and controlling the direction of current in the preceding block.

5. In a block-signal system, a counterweighted three-position signal-operating mechanism for driving said signal from "danger" to "caution" and "clear," a switch operated by said driving mechanism, two track-relays, one polarized and one non-polarized, conjointly with said switch controlling said operating mechanism, and a snap-switch operated by said mechanism and arranged to reverse the direction of current-flow in the preceding block while said signal is moving from "danger" to "caution."

6. In a block-signal system, a three-position signal, driving means therefor, a reversing-switch included in the track-circuit of the preceding block, and operative connections between said signal and said switch whereby said switch is shifted from one position to the other while said signal is being moved from "danger" to "caution" and is not shifted when said signal is moved from "caution" to "clear."

7. In a block-signal system, a three-position signal, driving means therefor, and a switch mechanically connected to said signal for reversing the flow of current in the track-circuit of the preceding block while said signal is being moved from "danger" to "caution."

8. In a block-signal system, a counterweighted three-position signal, an electric motor for driving said signal, two sets of contacts, controlling means for said contacts connected in the track-circuit and adapted to close one set of contacts upon a flow of current through said controlling means regardless of direction and to close the other set upon a flow of current in one direction only, a switch operated by said signal and adapted to connect either set of contacts in the motor-circuit, and contacts controlled by said signal and adapted to reverse the direction of current-flow in the preceding block.

9. In a block-signal system, a counterweighted three-position signal, an electric motor for driving said signal, two sets of contacts, controlling means for said contacts connected in the track-circuit and adapted to close one set of contacts upon a flow of current through said controlling means regardless of direction and to close the other set upon a flow of current in one direction only, a switch operated by said signal and adapted to connect one set of contacts in the motor-circuit when the signal is at "danger," to cut said set out of circuit and to cut the other set in when the signal is at "caution," and to cut both sets out of circuit when the signal is at "clear," and contacts controlled by said signal and adapted to reverse the direction of current-flow in the preceding block.

10. In a block-signal system, a counterweighted three-position signal, means for driving said signal from "danger" to "caution" and "clear," electrically-controlled means for locking said signal at "caution" and "clear," two sets of contacts, controlling means for said contacts connected in the track-circuit and adapted to close one set of contacts upon a flow of current through said controlling means regardless of direction and to close the other set upon a flow of current in one direction only, a switch operated by said signal arranged to cut either of said sets of contacts into circuit with said locking means, and a reversing-switch operated by said signal and included in the track-circuit of the preceding block.

11. In a block-signal system, a counterweighted three-position signal, means for driving said signal from "danger" to "caution" and "clear," electrically-controlled means for locking the signal at "caution" and "clear," a switch controlled by said signal and comprising contacts included in the circuit of said locking means, two track-relays, one polarized and one non-polarized, said non-polarized relay being arranged when energized to close the circuit of said locking means through said switch when said signal is at "caution," and the polarized relay being arranged when energized to break said circuit when said signal is at "caution" and to close said circuit through said switch when said signal is at "clear," and a reversing-switch included in the track-circuit of the preceding block and arranged to be shifted by said signal while said signal is moving from "danger" to "caution" position.

12. In a block-signal system, a counterweighted three-position signal, means for driving said signal from "danger" to "caution" and "clear," electrically-controlled means for locking said signal at "caution" and "clear," a switch controlled by said signal and having contacts included in the circuit of said locking means, and two track-relays, one polarized and one non-polarized, conjointly with said switch controlling said locking means, said polarized relay being arranged when energized to cut the contacts of the other relay out of the circuit of said locking means.

13. In a block-signal system, a counter-weighted three-position signal, means for driving said signal from "danger" to "caution" and to "clear," electrically-controlled means for locking said signal at "caution" and "clear," a switch controlled by said signal and having contacts included in the circuit of said locking means, and two track-relays, one polarized and one non-polarized, conjointly with said switch controlling said locking means, said polarized relay being arranged when energized to cut the contacts of the other relay out of the circuit of said locking means, and said switch being arranged to cut said contacts out of said circuit when said signal is in "danger" position.

14. In a block-signal system, a counter-weighted three-position signal, an electric motor for driving said signal, two sets of contacts, controlling means for said contacts connected in the track-circuit and adapted to close one set of contacts upon a flow of current through said controlling means regardless of direction and to close the other set upon a flow of current in one direction only, a switch operated by said signal and adapted to connect one set of contacts in the motor-circuit when the signal is at "danger," to cut said set out of circuit and to cut the other set in when the signal is at "caution," and to cut both sets out of circuit when the signal is at "clear," and means for automatically reversing the direction of current-flow in the preceding block when said signal is moved from "danger" to "caution."

15. In a block-signal system, a counter-weighted three-position signal, an electric motor for driving said signal from "danger" to "caution" and "clear," a clutch-magnet for clutching said signal to said motor, electrically-controlled locking means for locking said signal at "caution" and "clear," a switch operated by said signal, means connected to the track-circuit and responsive both to current-flow and to reversal of current in said circuit and conjointly with said switch controlling said motor, clutch-magnet, and locking means, and means for automatically reversing the direction of current-flow in the preceding block when said signal moves from "danger" to "caution."

16. In a block-signal system, a counter-weighted three-position signal, an electric motor for driving said signal from "danger" to "caution" and "clear," a clutch-magnet adapted to clutch said signal to said motor, electrically-controlled locking means for locking said signal at "caution" and at "clear," a switch operated by said driving mechanism, two track-relays, one polarized and one non-polarized, conjointly with said switch controlling said motor, clutch-magnet, and locking means, and means for automatically reversing the current in the preceding block when the non-polarized track-relay is energized to shift said signal from "danger" to "caution."

In witness whereof I have hereunto set my hand this 24th day of January, 1905.

LAURENCE A. HAWKINS.

Witnesses:
BENJAMIN B. HULL,
HELEN ORFORD.