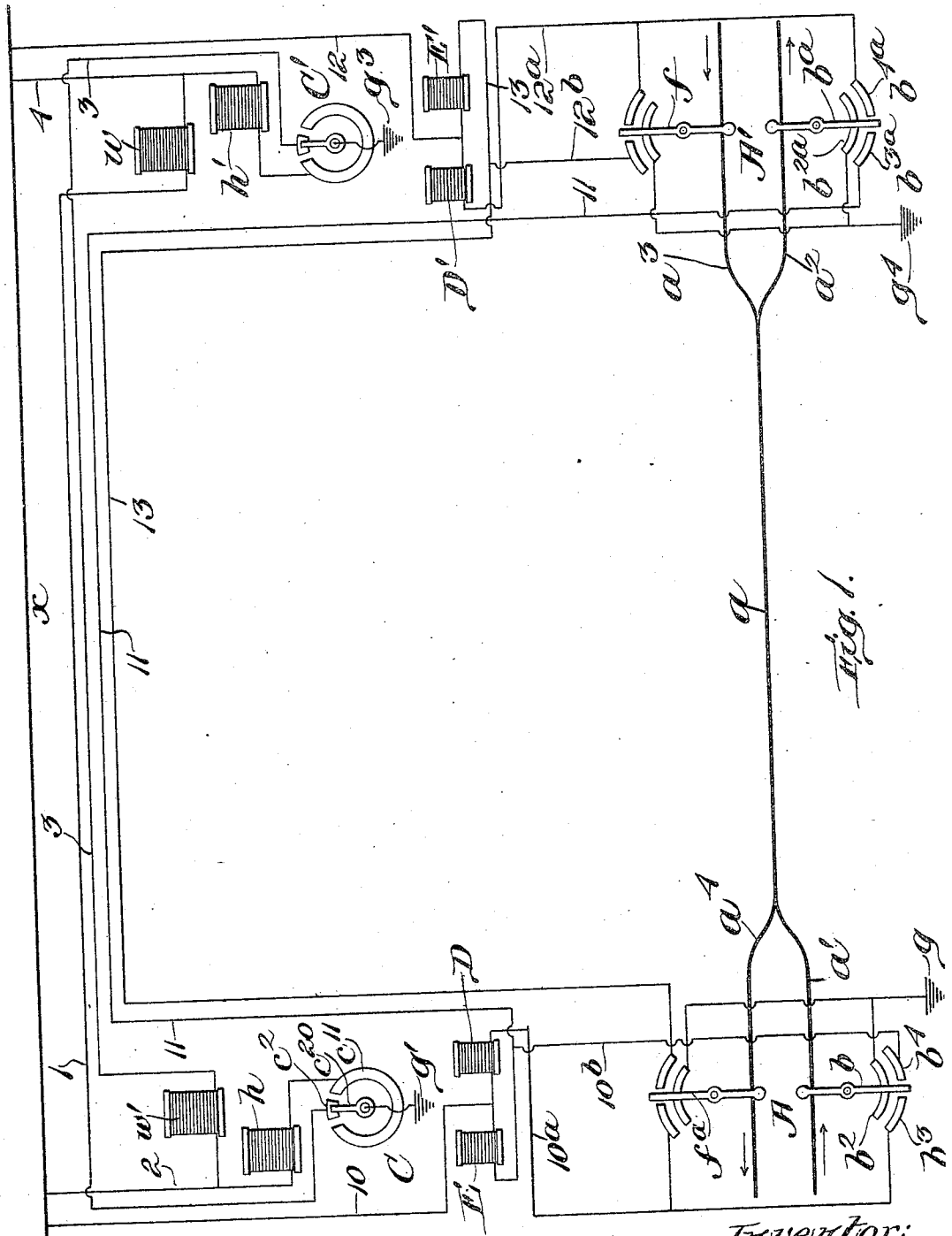


G. H. SLOANE.
 AUTOMATIC SIGNALING SYSTEM FOR RAILWAYS.
 APPLICATION FILED MAY 26, 1908.

Patented Dec. 7, 1909.
 3 SHEETS—SHEET 1.

942,468.



Witnesses:

Arthur F. Randall
 Katherine A. Dugan

Inventor:

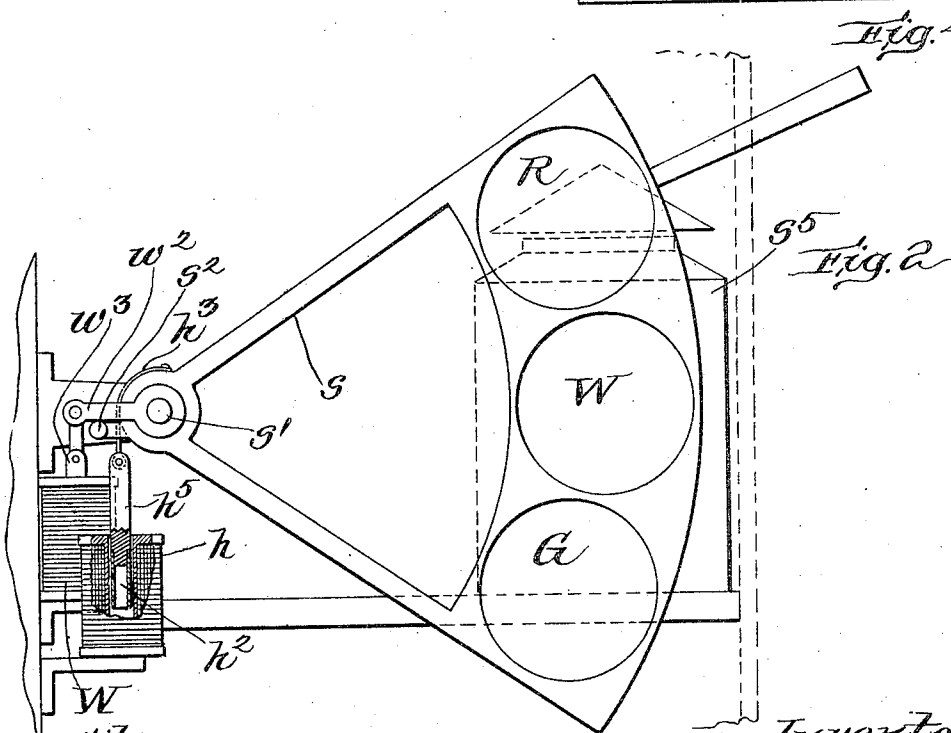
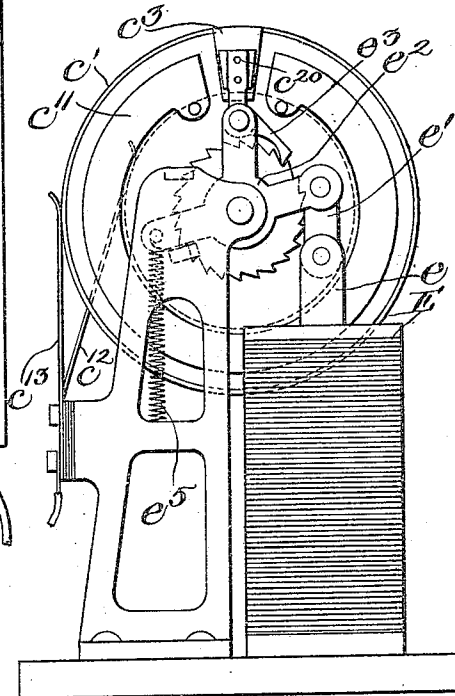
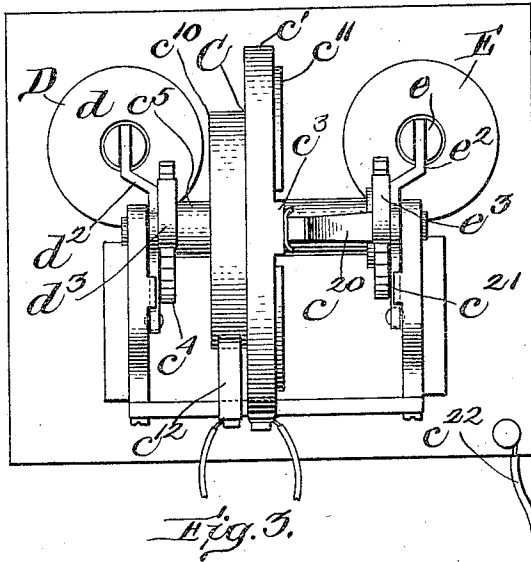
George H. Sloane
 by Geo. N. Goddard
 Atty.

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Inventor:

George H. Sloane
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UNITED STATES PATENT OFFICE.

GEORGE H. SLOANE, OF BOSTON, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO HERBERT B. WATERS AND HAROLD PLIMPTON.

AUTOMATIC SIGNALING SYSTEM FOR RAILWAYS.

942,468.

Specification of Letters Patent.

Patented Dec. 7, 1909.

Application filed May 26, 1908. Serial No. 435,157.

To all whom it may concern:

Be it known that I, GEORGE H. SLOANE, a citizen of the United States, and resident of Boston, county of Suffolk, Massachusetts, have invented certain new and useful Improvements in Automatic Signaling Systems for Railways, of which the following is a specification.

This invention relates to an automatic signaling system for railways and is intended to provide a simple, reliable, and efficient arrangement by which the operator of an approaching car or train may be reliably and positively informed by automatic signals whether the block ahead of him is clear or is occupied by a train or car and in the latter case the direction in which said train or car is moving through the block.

The system comprising my invention employs at each end of the block a suitable visible signaling means, preferably a semaphore, each semaphore being controlled by a pair of electromagnets or solenoids, the action of the solenoids being in turn controlled by an automatic switch device which is actuated or shifted by the agency of the car as it approaches the block.

One of the features characterizing the invention consists in the combination with each switch of two independent circuits, one being a local circuit for displaying a cautionary signal at the entering station, the other circuit extending to the distant station at the farther end to display a clear signal when energized and a danger signal when released, the switch acting to alternately maintain a current through one or the other of said circuits.

Another feature of the invention consists in the combination with a semaphore or signaling device of two actuating electromagnets embraced in independent circuits and so arranged with relation to the semaphore that the energizing of one of them has no effect upon the semaphore until the other has been energized.

A third feature of the invention resides in the construction and arrangement by which the over-running or passing by of the contact member or circuit closer actuated by the car creates no disturbance of the signals set by a car already on the block yet operates to maintain the appropriate signals for the

car so over-running as soon as all cars on the block have passed out.

These and other features of the invention will be more particularly described in the following specification and defined in the claims forming part thereof.

In the accompanying drawings I have illustrated the preferred mode of embodying the principles of my invention, of which—

Figure 1 is a diagrammatic view illustrating the various circuits of the system in relation to each other and the operative parts thereof. Fig. 2 is a side elevation, partly broken away, of the semaphore or signaling device. Fig. 3 is a plan view of the electrically actuated automatic switch for alternating the currents between the different semaphore magnets. Fig. 4 is a side elevation thereof. Fig. 5 is a plan view of a circuit closer or contact member by which the action of the switch is controlled.

I will first describe the arrangement of the various circuits and their function and operation, thereafter describing the particular mechanism by which the various operations are performed.

In the drawings I have illustrated the system in its application to a single track electric railway, the single track section *a* and branches or turnouts *a'*, *a¹* and *a²*, *a³* being shown at each end. For convenience I have designated the left hand side as station *A* and the right hand side as station *A'*, it being understood that for the purposes of this description the cars coming in either direction are assumed to be entering the block section *a* on the right hand track or turnout.

At each station is located a three-signal semaphore such as is illustrated in Fig. 2. This semaphore as illustrated comprises a sector frame *s* bearing three circumferentially arranged disks *R*, *W*, *G*, the first being preferably of red glass to indicate danger, the second of white glass to indicate a clear signal, and the third of green glass to indicate a cautionary signal. The semaphore frame is loosely mounted on a journal shaft *s'* and is provided at its rear end with a curved projection or hook *s²*. A strap or chain *h³* passing around the hub of the semaphore is connected to the magnet core *h⁵* of the solenoid *h*. The electro-magnet or solenoid *w* has also a movable

core w^3 which is connected by a link to an arm w^2 loosely mounted upon the shaft s' in position to rest above and engage the projecting hook s^2 secured to the frame of the semaphore. The semaphore also carries a forwardly projecting arm or finger s^3 in addition to the lenses described. The semaphore is boxed in in the usual fashion as indicated in dotted lines, the box carrying a suitable lamp arranged in the horizontal plane of the semaphore shaft so as to be midway of the extreme positions of the semaphore. Obviously when neither of the solenoids h or w is energized the semaphore will drop by gravity to its lowermost position with the lens R opposite the lamp, thus displaying the danger signal. At this point the magnetic iron core h^5 of the solenoid h is withdrawn entirely out of the solenoid and is rendered inoperative even if the coil be energized. The iron core h^2 is provided as shown with a downwardly extending sleeve h^2 of non-magnetic material such as copper or brass so as to form a guide to insure the return of the iron core h^5 into the central bore of the coil when the semaphore is raised by the energizing of the magnet coil w . It will be understood that the energizing of the solenoid coil h , when the semaphore is in the danger position, will have no effect upon the core h^5 . When however, the solenoid coil w is energized the core w^3 is turned downward into its coil pulling down the arm w^2 which by its engagement with the hook or arm s^2 serves to raise the semaphore to the middle position displaying the white lens in front of the lamp. If the solenoid coil h has already been energized or if it shall thereafter be energized it will then act through the core h^5 and the strap h^3 to still further raise the semaphore in order to display the green or cautionary signal before the lamp. The arm s^3 forms an additional indicator of the position of the semaphore. If one of these semaphores be placed at each station A and A' and a current be maintained through the respective switches C C', whose construction will be hereinafter explained, and the electromagnets or solenoids $w w'$, it will be obvious that both semaphores will be held at the middle position indicating a clear signal. Through each of the controlling switches are arranged two independent circuits, one of which when closed embraces the electromagnet w at the distant station A' and the other of which when closed by said switch embraces magnet h at the station A. In other words the switch C according to its position will maintain a closer local circuit embracing the local magnet h or else it will maintain a closed circuit for the distant electromagnet w .

In one case the course of the circuit is

from the ground terminal g' through contact c^{20} , c^2 , line wire 1, magnet w , to the supply main x . If now the switch be shifted or changed the circuit will then be from the ground terminal g' through c^{20} , c^{11} , local line 2, directly to the main conductor x . It will be noticed that the currents through these circuits are maintained alternately but that it is impossible to maintain both simultaneously. Consequently when the contact member c^{20} forms a contact with c^{11} the current flowing from the supply main x through the magnet w is cut out, while the magnet h is cut into the circuit. The deenergizing of magnet w allows the semaphore to fall by gravity to display the red or danger signal at the station A. The energizing of the magnet h at station A' raises the semaphore at that station to its uppermost position to there display the green lens indicating a cautionary signal for a car approaching the block through station A. The shifting of the magnet is accomplished by means of the contact member b at station A which is momentarily swung on its center to connect the contact b^2 leading to the ground terminal at g with line terminal b^3 which is connected by local line 10^a with magnet D and local line wire 10. The car having passed through the block a displaying the cautionary signal behind it and the red or danger signal at station A', actuates the switch $b a$ after entering upon track a^2 so as to form a ground connection between $b^3 a$ and $b^2 a$. From $b^3 a$ the circuit extends through line wire 11 back to station A through electromagnet E and wire 10 in order to restore the switch to the original position maintained by it before the car had actuated the circuit closer b at station A. By this restoration of the switch the circuit is maintained through the switch and line wire 1 to once more energize electromagnet w at station A' so that the semaphore at station A' will be shifted to display a white or clear signal. This shifting of the switch C simultaneously serves to cut out or deenergize solenoid h at station A leaving the semaphore at said station under the sole influence of solenoid w' which is in circuit through line wire 3 and switch c' with the ground terminal g^3 . Hence, the car upon entering the block sets a cautionary signal behind it and a danger signal at the far station, while on leaving the block the same car through contact $b a$ restores the switch C so that clear signals are once more displayed at both ends of the block. Precisely the same action takes place when a car is advancing toward the block along track a^3 . In this case through the switch f a circuit is made between the ground terminal g^4 , switch f , line 12^a, magnet D', and the wire 12 leading to the main conductor x , whereby through the temporary energizing of the

magnet D', the switch C' is shifted to maintain a circuit from the ground terminal g^3 through the switch solenoid h' and line 4 to the main conductor x . When this same car 5 passes out of the block on track a^4 it actuates contact f^4 to form a temporary ground connection through terminal g , line wire 13, through magnet E', and wire 12 to the main conductor x , thus causing the restoration of the switch C' to its initial position and cutting out the magnet h' . 10

Each circuit closer or car actuated contact may be made double acting so that the same effect is produced whether the car 15 enters either station on the right hand track or on the left hand track. It is also to be observed that as long as the system is maintained in working order and no car has entered the block, the signals at both ends are maintained by their respective electric circuits to indicate a clear track, while the accidental breaking of connections allows the semaphores to be set at the danger point. 20 Moreover, after one car has entered the block from one end, another car entering from the other end against the danger signal displayed does not operate to disturb or change the signal set by the first car, nor does a car following the first car entering the 30 block in the same direction disturb the signals set by said first car, but as will be hereinafter shown the switch is operated by said second car in such a manner as to maintain the proper signals after the first car has 35 passed out of the block. By arranging the switch circuits so that the current is maintained constantly through the switch, either through one circuit or the other, the disadvantages of making and breaking a circuit 40 are eliminated.

I will now describe the preferred form of circuit closer which I have illustrated in Fig. 5. This circuit closer embraces a pivoted arm b mounted upon a horizontal supporting frame or yoke b' , which latter is 45 provided with an arc-shaped contact strip b^2 of copper or the like and two shorter arc-shaped strips b^3 b^4 insulated from each other and from the first named strip b^2 . When the arm b is in the middle or neutral position it is in contact only with contact piece b^2 . 50 The other end of the arm is arranged to lie adjacent to some portion of the passing car, say the trolley hub and carries an antifric-tion wheel b^{15} adapted to be engaged thereby so that a car moving in the direction of the arrow in Fig. 5 will swing the arm b so that its contact end forms a bridge or connection between the contact pieces b^2 and b^3 . 55 To control the movement of the contact arm b and to restore it in the proper manner to a neutral position after the car has passed, I provide two plunger rods b^6 having their ends enlarged to engage the walls of an ori-

fice b^5 formed in the arm b , through which 65 orifice they are loosely passed. These plunger rods b^6 pass into a cylinder b^9 and carry at their inclosed ends pistons b^7 . The said pistons are normally pressed outward away from the arm b by means of the compressed 70 spiral springs b^8 . The outer end of the cylinder b^9 is provided with air inlet holes covered by a flat valve b^{10} to admit air when the piston is moved forward against the tension of the spring. The cylinder is also provided 75 with a by-pass chamber b^{11} provided with a small vent orifice b^{12} . The car passing in the direction of the arrow swings the contact end of the lever so as to advance the piston b^7 in the right hand cylinder, thereby 80 compressing the spring b^8 and relaxing the tension of the spring in the opposite cylinder. As the piston b^7 moves toward the inner end the air entering through the inlet ports fills the outer end of the cylinder but 85 on the return of the piston b^7 is compressed and escapes very slowly through the small vent b^{12} thus retarding the action of the compressed spring b^8 in restoring the arm b to the neutral position. This retardation 90 continues so long as the piston b^7 has not advanced outwardly beyond the inner end of the bypass b^{11} . As soon however, as that bypass is uncovered in this outward traverse of the piston, the retardation ceases and the 95 spring acts with a sudden movement to complete the return of the arm b , the parts being proportioned so that this sudden release or movement of the arm b operates to suddenly break the electrical connection with 100 the contact piece b^3 to prevent sparking. As the two spring-actuated piston rods b^6 are maintained in balance when in the neutral position, a precisely similar action occurs when a car passing in the opposite direction 105 actuates the circuit closer.

The circuits made respectively through contact pieces b^3 , b^4 are employed to actuate respectively electromagnets or solenoids which operate the automatic switches C C'. 110 In its essential features the switch comprises a stepped wheel or disk of two diameters, the smaller of which has a peripheral contact ring c^{10} and the larger of which has a peripheral contact ring c^7 . This stepped 115 wheel is rotated intermittently with its respective contact rings in permanent contact with their respective collecting brushes c^{13} c^{12} . The contact ring c^7 is electrically connected with a sector-shaped contact piece c^3 120 arranged on the lateral face of the disk, while the contact ring c^{10} is electrically connected with a horse-shoe shaped contact piece c^{11} which like the contact piece c^3 is insulated from the supporting disk. An insulated contact arm c^{20} is loosely mounted 125 on the shaft c^5 of the stepped disk and is connected with a ratchet wheel c^{21} which is

engaged by a pawl c^3 carried by a yoke or arm e^2 which is connected by means of a link e' with the solenoid core e of the solenoid E. A retractile spring e^5 secured to the opposite side of the arm or yoke e^2 serves to retract the pawl after it has been pulled down and stopped by the action of the solenoid core e whose movement is caused by the energizing of the solenoid coil.

10 By a similar electromagnet or solenoid D the shaft D^5 carrying the stepped switch wheel is intermittently rotated through the agency of the solenoid core d connected with the arm d^2 carrying the pawl d^3 engaging the ratchet wheel c^4 .

If solenoid D is energized the arm d^2 is pulled down and through the engagement of the pawl d^3 and ratchet c^4 rotates the shaft c^5 to which the stepped wheel is secured a single step forward. The magnet D is energized through the circuit temporarily established by the arm b bridging a gap between contact pieces b^2 and b^3 , while the return of said arm b to the neutral position by breaking the circuit through the solenoid D allows the arm d^2 and the pawl d^3 to be restored to their initial position in readiness to be again actuated by the energizing of the solenoid. If we assume the switch to be in the position shown in Figs. 1 and 4 the energizing of the solenoid D by rotating the contact wheel of the switch brings contact member c^{11} into electrical connection with the arm c^{20} and simultaneously breaks the electrical connection made through the brush or contact finger c^{13} , ring c' , and sector c^3 . This circuit maintained through the arm c^{20} and the ring c^{11} acts as shown in the diagram Fig. 1, to maintain a circuit energizing electromagnet h of the local circuit to display a cautionary signal, while deenergizing distant magnet w to display a danger signal at the farther station. When the car passes off the block at station

45 A through the temporary connection established through circuit closer b a magnet E is energized at station A and contact arm c^{20} is then advanced by its solenoid E to overtake and come in contact with contact member c^3 thus reestablishing the circuit originally maintained through the switch C. If however, a number of cars follow the first car into the block before the cars in advance of it have passed out of the block, they will each of them in succession rotate the contact disk one further step in advance, while on passing out of the block they will successively rotate the contact arm c^{20} successively one step in advance, the signal however remaining the same until by the passage of the last car out of the block the contact between arm c^{20} and contact sector c^3 is reestablished.

By this system of signaling any number

of cars can advance slowly into the block through the station displaying a cautionary signal and will not disturb the signal set by the car in advance of it and will at the same time maintain the signals in proper position when the cars in advance of it have passed out of the block. In case one or more cars should advance into the block from the other end against the danger signal displayed to them they will not disturb the signals maintained by the cars having the right of way through the block and thus the system affords evidence to fix responsibility for passing by a danger signal. Moreover, if a car advancing toward the danger signal should run by its circuit-closer before stopping and should fail to go back far enough to reset the switch, no harm would be done as the appropriate signals to indicate its having entered on the block will be automatically displayed as soon as the cars advancing from the opposite direction have passed out of the block. On the other hand should the motorman after having run by the circuit-closer at the entry end of the block then back his car so as to return back of the circuit-closer, the switch members will then be returned to their initial relationship by reason of the fact that the circuit-closer is double acting and operates to actuate one member of the switch when moved in one direction and the other member of the switch when moved in the opposite direction.

What I claim is:—

1. In an automatic signaling system for a railway block, a visible signaling device located at each end of said block, an automatic switch also located at each end of the block for maintaining a current through two alternative electric circuits, the one a distant circuit acting when energized through said switch to set the distant signal to show a clear track, the other circuit being a local circuit acting when energized to set the local signal at cautionary position to indicate the presence of a car moving through the block in advance of the car actuating the switch, substantially as described.

2. In an automatic signaling system for a railway block, the combination of a signaling device located at each end of the block and embracing a three-position target, a pair of electro-magnets for controlling the position of said target, one magnet acting when energized to keep the target in position to indicate a clear track, the other magnet when energized acting to display a cautionary signal, the second magnet being inoperative to move the signal except when the first magnet is energized, substantially as described.

3. In an automatic signaling system for a railway block, the combination of a signal-

ing device located at each end of the block and embracing a three-position target actuated by gravity to move into danger position when its controlling magnets are deenergized, a pair of electro-magnets for controlling the position of said target, one magnet acting when energized to keep the target in position to indicate a clear track, the other magnet when energized acting to display a cautionary signal, the second magnet being inoperative to move the target except when the first magnet is energized, substantially as described.

4. In an automatic signaling system for a railway block, the combination of a signaling device located at each end of the block and embracing a three-position target arranged to move to danger position when its controlling magnets are deenergized, one magnet acting when energized to move the target from danger position to clear position, the second magnet when energized acting to move the target from the clear position to cautionary position and being inoperative to move the target from its danger position, substantially as described.

5. In an electric signaling system for a railway block, the combination of a circuit closer located at each end of the block and actuated by the car passing the same, an automatic switch for maintaining an electric current through alternative circuits, the one a distant circuit acting to control a target at the farther end of the block, the other a local circuit acting to control a local target, the switch acting to shunt the current from the distant circuit that maintains the distant target at the clear position to the local circuit which maintains the local target at cautionary position, the distant target being moved by gravity to danger position when said shifting action of the switch has occurred, substantially as described.

6. In an automatic signaling system for a railway block, the combination of a rotary switch located at each end of the block and adapted to be automatically operated by the passing car, a three-position target located at each end of the block, a pair of electro-magnets for controlling each target, one magnet being energized by the distant switch to move its target from danger to clear, the other magnet being energized by the local switch to move its target from clear to cautionary position, said target being actuated by gravity to move to danger position when neither magnet is energized, substantially as described.

7. In an automatic signaling system for a railway block, the combination of an automatic switch located at each end of the block and controlling two alternative circuits, one of said circuits embracing an electro-magnet for moving a target at the distant station to

clear position, the other circuit being a local circuit for moving a target at the local station to cautionary position, the shifting of the switch from the distant circuit to the local circuit causing the deenergization of the distant magnet allowing the distant target to move to danger position, said switch being operated by each successive car entering the switch behind the first car without disturbing existing signals and being restored to reestablish the current through the distant circuit by the last car leaving the block, substantially as described.

8. In an automatic signaling system for a railway block, a signaling device embracing a pivoted arm bearing three different signals to indicate respectively a clear signal, a cautionary signal, and a danger signal, said arm when not under the influence of its controlling magnets being normally held to display the danger signal, an electro-magnet acting when energized to move the signal arm from danger to clear position, a second electro-magnet acting when energized to move the signal arm from clear to cautionary position, the latter magnet being inoperative when energized to move the arm from the danger position, substantially as described.

9. In an automatic signaling system the combination with a three-position target pivotally mounted on its support actuated by gravity to be moved to one extreme position, of an electromagnet whose movable core is connected with the target when the target is in one extreme position under the influence of gravity, the core of said magnet being lifted out of the magnet coil, a second electromagnet whose core is connected with an arm loosely engaging a portion of the target to hold the target at the middle position when said magnet is energized, substantially as described.

10. A signaling device embracing a pivoted signal arm movable into three distinctive positions and operated by gravity to move to and remain in one extreme position, an electromagnet, and means connecting said signal arm with the core of said electromagnet whereby said magnet core is raised entirely out of its surrounding coil when the signal arm occupies the extreme position due to gravity, a nonmagnetic extension connected to the lower end of said core to guide the core back into the magnet coil when the signal arm is returned to the middle position, and a second magnet whose solenoid has connection with said signal arm to move the same to the middle position while permitting the first magnet when energized to move the signal arm from the middle position to the other extreme position, substantially as described.

11. An automatic signaling device embracing the pivoted arm or frame & the mag-

net h whose magnetic core h^5 is provided
with a non-magnetic extension h^2 , the con-
nection h^3 for attaching said magnet core to
the frame s , the second magnet w whose core
5 w^3 is connected with an arm w^2 having loose
engagement with the projection s^2 of the
frame s , substantially as described.

In witness whereof, I have subscribed the
above specification.

GEORGE H. SLOANE.

In the presence of—

GEO. N. GODDARD,
KATHARINE A. DUGAN.