Oct. 29, 1940. W. F. SCHLEICHER 2,219,757

CROSSING SIGNAL

Filed Jan. 12, 1939 2 Sheets-Sheet 1

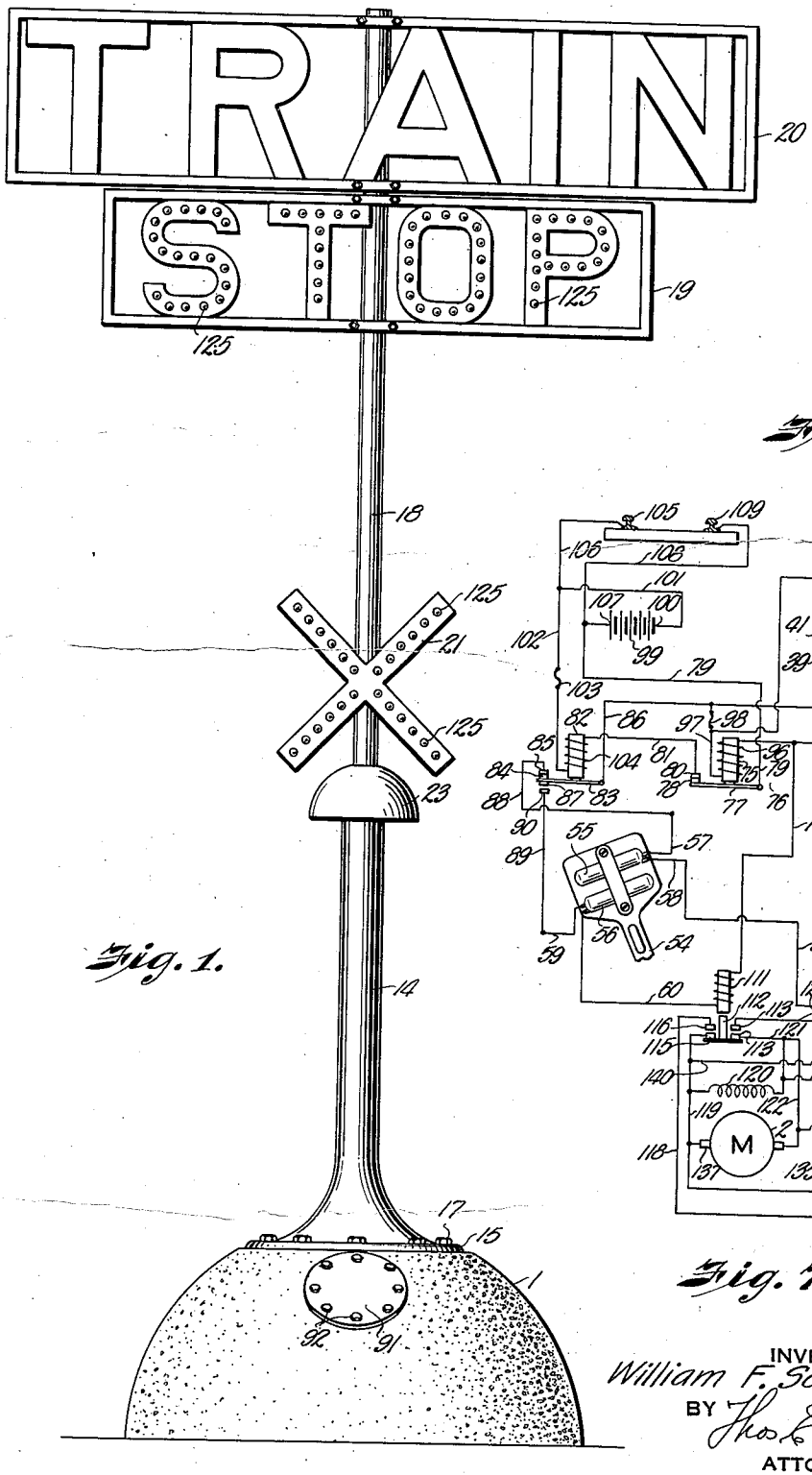


Fig. 1.

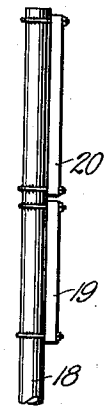


Fig. 2.

Fig. 7.

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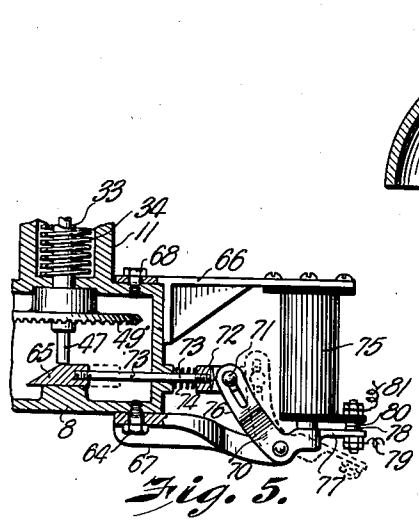


Fig. 5.

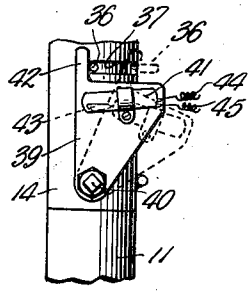


Fig. 6.

Fig. 3.

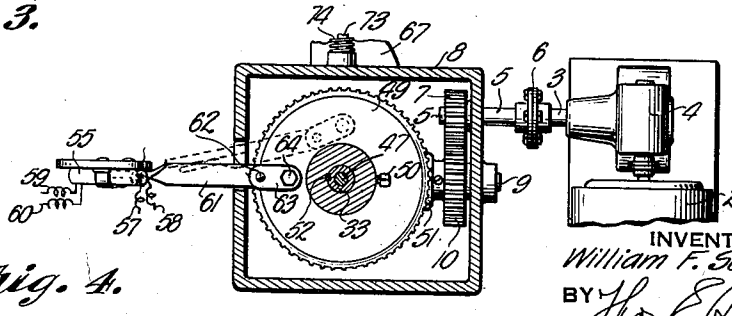


Fig. 4.

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UNITED STATES PATENT OFFICE

2,219,757

CROSSING SIGNAL

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Application January 12, 1939, Serial No. 250,542

2 Claims. (Cl. 246—128)

My invention relates to a crossing signal and more particularly to a signal used at railway highway crossings to warn traffic on the highway of the approach of traffic on the railway.

It has been suggested to provide crossing signals adapted to be actuated automatically by the approach of a train and thus avoid dependance upon a crossing watchman. This enables the use of more crossing signals than would otherwise be possible, due to economic reasons.

Where crossing signals are employed, it is of the utmost importance that they are always in operative condition. The public relies on crossing signals and, if the signal should be in the "clear" position during the approach of a train, the signal would operate as a trap.

One object of my invention is to provide an automatic, electrically operated crossing signal which will automatically move to a position stopping highway traffic upon the approach of rail traffic.

Another object of my invention is to provide a crossing signal of the character described, which will automatically move to a position warning highway traffic when electric power fails, even though no train is approaching.

Another object of my invention is to provide an automatic crossing signal which will move to "clear" position after the train has passed.

Other and further objects of my invention will appear from the following description.

In the accompanying drawings which form part of the instant specification and are to be read in conjunction therewith and in which like reference numerals are used to indicate like parts in the various views;

Figure 1 is an elevation of my crossing signal shown in the "stop" position.

Figure 2 is a fragmentary elevation of the upper portion of my signal in the "clear" position.

Figure 3 is an enlarged sectional elevation of the lower portion of my crossing signal.

Figure 4 is a sectional view taken on the line 4—4 of Figure 3.

Figure 5 is a fragmentary view with parts in section, showing details of a safety feature.

Figure 6 is a fragmentary elevation of the signal light switch.

Figure 7 is a diagrammatic view of the wiring diagram of my crossing signal.

Referring now to the drawings, with a base member 1 which may be of concrete or of any other suitable material, I house an electric motor 2. The electric motor 2 is adapted to drive a shaft 3 through a transmission situated within housing 4. The shaft 3 is adapted to drive shaft 5 through coupling 6. The shaft 5 extends into the housing 8. Keyed to the end of shaft 5 is a pinion 7. A shaft 9 is journaled in suitable bearings within the housing 8. A gear 10 is keyed to shaft 9 and meshes with the pinion 7. The housing 8 is provided with an upwardly extending tubular portion 11, which is supported from tubular portion 12 by means of stud bolts 13. The tubular portion 12 forms part of a hollow standard 14. The standard 14 terminates in a lower flange 15. The upper portion of the base member 1 is formed with a seating ring 16 to which the flange 15 is secured by means of stud bolts 17. Rotatably mounted within the standard 14 I provide a signal shaft 18. The signal shaft 18 extends upwardly and carries a stop signal 19 at its upper end. A plurality of signs such as 20 and 21 may likewise be secured to the shaft 18. The upper end of the standard 14 is formed with an annular trough 22. A rain guard 23 is keyed to the signal shaft 18. The rain guard 23 is formed with an annular flange 24 adapted to enter the annular trough 22 to form a labyrinth packing, sealing the base member and the lower portion of the standard 14 from moisture. The rain guard 23 carries one member 25 of a thrust bearing, the other member of which, 26, is carried by the standard. It will be seen, therefore, that the weight of the shaft is rotatably carried by the thrust bearing. The lower end of shaft 18 carries a shaft 27 of reduced cross diameter. The shaft 27 is secured to shaft 18 by means of pins 28 and 29. Tubular member 12 houses a guide bearing 30 which serves to guide the lower end of shaft 27. Shaft 27 projects through the guide bearing 30 and is secured to an annular bushing 31 by means of pin 32. A hollow shaft 33 projects into bushing 31. One end of a spring 34 is secured to the lower end of bushing 31. The other end of the spring 31 is secured to the housing 8. The spring is such that it tends to rotate the bushing in a clockwise direction, viewed from above, that is, in such direction that the crossing signal is moved to "stop" position.

The lower end of shaft 18 is provided with a collar 35 which is secured thereto in any suitable manner. The collar 35 carries a pin 36 which extends radially outward through a ninety degree slot 37, formed in the tubular portion 12. The pin extends in the direction of the stop signal and serves two purposes. The first purpose served by the pin 36 and the radial ninety degree slot 37 is that of a stop member limiting the motion of the shaft 18. For example, when the shaft 18

is rotated to "stop" position under the influence of spring 34, it will rotate until the pin 36 engages the end of the slot 37, thus assuring that the signal will be rotated to the "stop" position. A boss 38 is formed at the lower end of the tubular portion 12. A member 39 is pivoted on the boss 38 and is held in place by a stud bolt 40. The member 39 carries a mercury switch 41 which is shown in full lines in the position it occupies when the signal is in "clear" position. It will be noted that the pin 36 engages a lug 42 and the mercury switch is mounted with a slight angle so that the mercury 43 is adapted to flow by gravity to the left side of the switch member 41.

Two contact points are housed within the mercury switch 41, connected to conductors 44 and 45. When the signal is rotated to "stop" position, the pivoted member 39 will move, under the influence of gravity, to the position shown in dotted lines in Figure 6, permitting the mercury to flow to the right and close the circuit through conductors 44 and 45 to energize signal lights as will be described more fully hereinafter.

A ball clutch 46 normally connects the bushing 31 and the shaft 33. The ball is held in clutching position by a shaft 47 which is formed with an upper cam portion 48. The lower end of shaft 33 projects into the housing 8. A bevel gear 49 is secured to the shaft 33 by means of a clamping bolt 50. The shaft 47 is slidable within the hollow shaft 33 but is keyed thereto for rotation therewith. A bevel pinion 51 is keyed to the shaft 9 and is always in mesh with the bevel gear 49. The hollow shaft 33 is keyed to the bevel gear 49 by means of key 52. The housing 8 is formed with an extension 53 to which is pivoted an arm 54 by means of pivot pin 55'. The arm 54 carries a pair of mercury switch members 55 and 56 similar in construction to the mercury switch member 41. A pair of conductors 57 and 58 enter the right hand side of the upper mercury switch 55. A pair of conductors 59 and 60 enter the left hand side of the lower mercury switch 56. The arrangement is such that, in the position shown in full lines in Figure 3, the mercury switch 56 operates to close the circuit through conductors 59 and 60, while in the dotted line position shown in Figure 3, the circuit through conductors 59 and 60 is broken while the circuit is completed through conductors 57 and 58 as will be described more fully hereinafter in connection with the wiring diagram shown in Figure 7.

The arm 54 is provided with a connecting link 61 which extends into the housing 8. The end of link 61 within the housing is pivoted by pivot 62 to a short link 63 which is in turn pivotally secured to an eccentric point on the bevel gear 49 by means of stud bolt 64.

The lower end of shaft 47 rests upon a cam member 65 as will be readily seen by reference to Figure 5. The cam member 65 is adapted to move to the right and to the left as viewed in Figure 5. In this figure, when the cam member is in the position shown in full lines, the shaft 47 is moved upwardly, enabling the cam surface 48 to cam the ball clutch 46 to a position locking bushing 31 with hollow shaft 33. When the cam 65 is moved to the right, to the position shown in dotted lines in Figure 5, the shaft 47 will drop by gravity, permitting the ball clutch 46 to move to unclutching position. A pair of brackets 66 and 67 are secured to the housing 8 by means of stud bolts 68 and 69. The bracket 67 carries a bell crank lever 70. The outer end of one lever arm 76 is connected by means of pin 71 to a yoke 72 carried by shaft 73 which extends into the housing 8 and carries at its outer end the cam member 65. A spring 74 normally urges the shaft 73 and hence the cam member 65 to the right, that is to unclutching position. An electromagnet 75 is carried by the bracket 66. It is adapted, when energized, to attract the other arm 77 of the bell crank lever against the action of spring 74 to maintain the parts in the positions shown in full lines in Figure 5. The arm 77 carries a contact point 78 to which conductor 79 is attached. The contact point 78, when the parts are in full line position, is adapted to make contact with contact point 80, with which conductor 81 is in electrical connection.

An electromagnet 82 is normally energized and is adapted to attract pivoted armature 83. Armature 83 carries an upper contact point 84 adapted to make contact with contact point 85. A conductor 86 is electrically connected to contact points 84 and 87, carried by the armature 83. An electrical conductor 88 is in electrical connection with contact point 85 and, when the electromagnet 82 is energized, conductors 86 and 88 will be electrically connected. A conductor 89 is electrically connected to a contact point 90. When the electromagnet 82 is de-energized, the pivoted armature 83 will drop under the influence of gravity, making connection between contact points 87 and 90 and hence between conductors 86 and 89. The base member 1 is provided with a manhole 91, enabling access to the interior of the base member. A plurality of stud bolts 92 removably secure the cover member to a seating member 93 cast in the base member 1.

Having in mind the construction just described, the operation of the device may be best understood by reference to Figure 7. In Figure 7, the circuit is shown with the signal in "clear" position. Energy is supplied from a pair of main line wires 94 and 95. Current will flow from line wire 95 through the winding 96 of the electromagnet 75 through conductor 97, through fuse 98 to the other side of the line 94. It will be seen, therefore, that, as long as the main line wires 95 and 96 are energized, the winding 96 of the electromagnet 75 will hold the armature 77 in a position in which the cam member 65 will hold shaft 47 in raised position locking the bushing 31 to the hollow shaft 33.

Current will also flow from one terminal 100 of a battery 99 through conductor 101 through conductor 102, through fuse 103 through the winding 104 of electromagnet 82 through conductor 81 to contact point 80, contact point 78, armature 77, conductor 79, to the other side of the battery 99. As long as current is flowing through the winding 104, the armature 83 will be attracted to make contact between contact points 84 and 85. The terminal 100 of the battery is connected to one track 105 through a conductor 106. The other terminal of the battery 107 is connected by conductor 108 to the other track 109. Normally, when no train is near the grade crossing, the battery will energize the winding 104 and maintain the members in the position shown in Figure 7, that is, with the signal in the "clear" position. Upon the approach of a train, the battery 99 will be shunted by the train wheels, completing the circuit across tracks 105 and 109, it being observed that the tracks run parallel with the winding 104 across the battery 99. Normally, the resistance of the tracks is sufficiently great to prevent a short circuit. When the train, however, approaches the crossing, a short cirruit is effected

to the extent of permitting a passage of a greater amount of current across the track circuit. Passage of current across the track circuit will decrease the amount of current flowing through the winding 104 so that the weight of the armature 83 will overcome the reduced magnetic pull permitting the armature to drop. When the armature drops, contact point 87 will make contact with contact point 90. When this occurs, current will flow from the main line wire 95 through conductor 110 through relay winding 111, through conductor 60, through mercury switch 56, through conductor 59, to conductor 89 to contact point 90, contact point 87, armature 83, conductor 86 to the other side of the line 94. The energization of the relay winding 111 will attract relay armature 112, causing contact point 113 to make contact with contact point 114 and contact point 115 to make contact with contact point 116. When this occurs, current will flow through conductors 117 and 118, contact point 116, contact point 115, to conductor 119. Current will then flow across field winding 120 to conductor 121 and across the armature of motor 2 to conductor 122, to conductor 121. From conductor 121, current will flow through contact point 113, through contact point 114, through conductor 123, through conductor 124 to the other side 94 of the line. The completion of the field circuit and armature circuit of the motor will cause the motor to rotate the signal to the "stop" position. Rotation of the motor will rotate shaft 3, shaft 5, pinion 7, gear 10, bevel pinion 51, bevel gear 49, hollow shaft 33, bushing 31, shaft 27 and signal shaft 18. As the rotation proceeds, the pin 36 will engage the lug 42 to complete the circuit across conductors 44 and 45. Current will flow from the main line wire 95 through conductor 45, through mercury switch 41, through conductor 44, through signal lights 125, through conductor 126 to conductor 97, through winding 96 to the other side 95 of the line. The signal lights 125 will thus be energized. It is to be understood, of course that, if desired, a warning bell 127 may be placed in parallel with the signal lights 125. As the motor rotates the signal to "stop" position, the bevel gear 49 will rotate, pulling the connecting link 61 to pivot arm 54. When the signal is in "stop" position, the arm 54 will have moved to the position shown in dotted lines in Figure 3. When this occurs, a connection across conductors 59 and 60, through mercury switch 56 is broken. When this connection breaks, relay winding 116 is de-energized and both the motor field and motor armature circuits will be broken, stopping the motor. The signal remains in the "stop" position, since the train provides shunting across tracks 105 and 109. After the train has passed the crossing a sufficient distance to increase the rail resistance to such a point that the current flowing through winding 104 is sufficient to again attract the armature 83, contact will be made between contact points 84 and 85, it being understood that the mercury switch 55 is in the dotted line position of Figure 3, completing the circuit across conductors 57 and 58. When this occurs, current will flow from one side of the line 95 through conductor 128, through relay winding 129, through conductor 58, through conductor 57, through conductor 88, through contact point 85, through contact point 84, through armature 83, through conductor 86, to the other side of the line, thus energizing relay winding 129 and attracting the relay armature 130 to make contact between contact point 131 and contact point 132, and contact points 133 and 134. Current will then flow through conductor 117, through conductor 135, through contact point 133, through contact point 134, through conductor 136 to the brush 137 of the motor, through the motor armature of the motor 2, through conductor 138, through contact point 132, through contact point 131, through conductor 124 to the other side 94 of the main line.

It will be observed that the armature current is in the same direction as before. Current will also flow from conductor 136 through conductor 139, through the field winding 120, through conductor 119, through conductor 140 to conductor 138 and through contact points 132 and 131, and conductor 124 to the other side 94 of the line. It will be observed that the field current is reversed with respect to the armature current when relay winding 129 is energized. This will cause the motor 2 to rotate in a direction opposite to that which it rotated when relay winding 111 was energized. As the motor rotates in the opposite direction, the signal will be moved to "clear" position. As the bevel gear 49 rotates in moving the signal to "clear" position, the connecting link 61 will move the arm 54 back to its full line position of Figure 3. Just when the signal is moved to "clear" position, the mercury switch 55 operates to break the circuit across the conductors 57 and 58, thus de-energizing the relay winding 129 and stopping the motor.

The normal operation of the device as long as the main line wires 94 and 95 are energized will be readily understood from the foregoing description.

Should, at any time, the main line wires become de-energized due to the failure of current supply or a break in the connections within the crossing signal itself, the winding 96 of the electromagnet 75 will become de-energized permitting the spring 74 to move the shaft 73 and the cam member 65 to the right. This movement will permit shaft 47 to drop under the influence of gravity. Clutch ball 46 will likewise drop into the hollow shaft 33 due to the downward motion of the cam portion 48, thus unclutching the hollow shaft 33 from the bushing 31. When this occurs, the spring 34 will rotate the bushing and hence the signal shaft 18, moving the stop signal to its "stop" position. In this manner, the signal will be moved across the crossing, warning highway traffic, even though power fails.

It will be observed that the armature 77 will be moved to make contact between contact points 78 and 80 when the main line power fails. Since the battery circuit is across contact points 78 and 80, the circuit through winding 104 of the electromagnet 82 will be broken, permitting armature 83 to drop.

When the signal shaft 18 is rotated under the influence of spring 34, the shaft 47 being keyed to the bevel gear 49 will be held stationary. This rotation of the hollow shaft 33 relative to the shaft 47 will displace the cam surface 48, moving the ball upwardly above the end of the shaft 47 and preventing the ball from dropping into clutching position. When the main line power is again restored, the winding 96 will be energized, tending to attract the armature 77 against the action of the spring 74. The armature, however, cannot move without moving shaft 73 and cam member 65. The cam member 65, in turn, cannot move without moving the shaft 47 upwardly. The shaft 47, however, will be held in a depressed position due to the relative rotation between the hollow shaft 33 and the bushing 31, trapping the ball above the end of the cam member 48. In other words, due to the fact that the

ball is displaced from its clutching groove, the shaft 47 is prevented from moving upwardly since, in order to move upwardly, it must move the ball outwardly. The armature 77, therefore, will remain in a position breaking the circuit between contact points 78 and 80, and maintaining the winding 104 in de-energized condition. The circuit will therefore be completed through mercury switch 56, which it will be recalled, was still in its full line position, and contact points 87 and 90. This will rotate the motor to signal "stop" position. Since the signal is already in "stop" position and the shaft 33 is unclutched from the bushing 31, this action will simply rotate the bevel gear 49, the hollow shaft 33 and the clutching shaft 47. When the hollow shaft 33 is rotated to realign the locking groove, the ball will be cammed by the camming surface 48 into its clutching position, permitting upward movement of the shaft 47, under the influence of movement of the cam 65. As soon as this occurs, contact is reestablished between contact points 78 and 80, thus again energizing the winding 104 of the electromagnet 82, causing the circuit to be completed across conductors 57 and 58 through the mercury switch 55. This, as will be readily understood, will rotate the motor 2 in the opposite direction, moving the signal to its "clear" position and rewinding the spring 34, putting the members in a position to again operate upon the approach of a train.

It will be seen that I have accomplished the objects of my invention. I have provided a positive automatic crossing signal which will move to "stop" and "clear" positions upon the approach and departure of a train across the grade crossing being protected. The signal is positively rotated to "clear" and "stop" positions by an electric motor. In event of power failure, energy stored in a spring which is wound upon the movement of the signal from "stop" position to "clear" position is used to automatically move the signal to "stop" position. This renders my signal completely automatic and operative to stop traffic under all conditions of danger. The signal being moved to "stop" position upon the failure of power, will automatically call attention to a derangement, if it be noted that no train is approaching. Upon the restoration of power, the signal automatically resumes operative position.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of my claims. It is further obvious that various changes may be made in details within the scope of my claims without departing from the spirit of my invention. It is, therefore, to be understood that my invention is not to be limited to the specific details shown and described.

Having thus described my invention, I claim:

1. In a crossing signal, a base, a vertical standard rotatably mounted on said base, a signal carried by said standard adapted to be rotated into respective positions across a highway intersecting a railway track and along said highway, an electric motor for rotating said standard to stop and clear positions, control means for said motor including track means actuated by a train approaching the intersection guarded by said signal for operating said motor to rotate the signal to stop position, means for reversing the operation of said electric motor to rotate the stop signal to clear position after the train has passed the intersection, a spring for rotating the signal to stop position, a clutch normally connecting said rotatable standard to said motor, said spring exercising insufficient torque to rotate said standard when it is clutched to said motor and of sufficient strength to rotate said standard when it is unclutched from said motor, and electrical means normally holding said clutch in operative position, the construction being such that, when said electrical means is deenergized by failure of electric potential, said clutch will move to unclutching position to permit said spring to rotate said standard to stop position.

2. A crossing signal including in combination a base, a vertical standard rotatably mounted on said base, a signal carried by said standard for rotation into respective positions across a highway intersecting a railway track and along said highway, an electric motor for rotating said standard to stop and clear positions, control means for said motor including track means actuated by a train approaching the intersection guarded by said signal, a motor for rotating the signal to stop and clear positions, a pair of switch members, means for operating said switch members in response to the rotation of said standard by said motor, one of said switch members connected in a circuit for interrupting electrical energy to said motor after the signal has been rotated from clear to stop position, and the other of said switch members connected to break the motor circuit after the signal has been rotated from stop to clear position, spring means tending to rotate said standard to stop position against the inertia of the armature of said motor, said spring means being of insufficient strength to overcome said armature inertia, a clutch normally connecting said standard to said armature, and electrical means holding said clutch in operative position, the construction being such that when said electrical means is deenergized by failure of power supply, said clutch will move to unclutching position to permit said spring to rotate said standard to stop position.

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