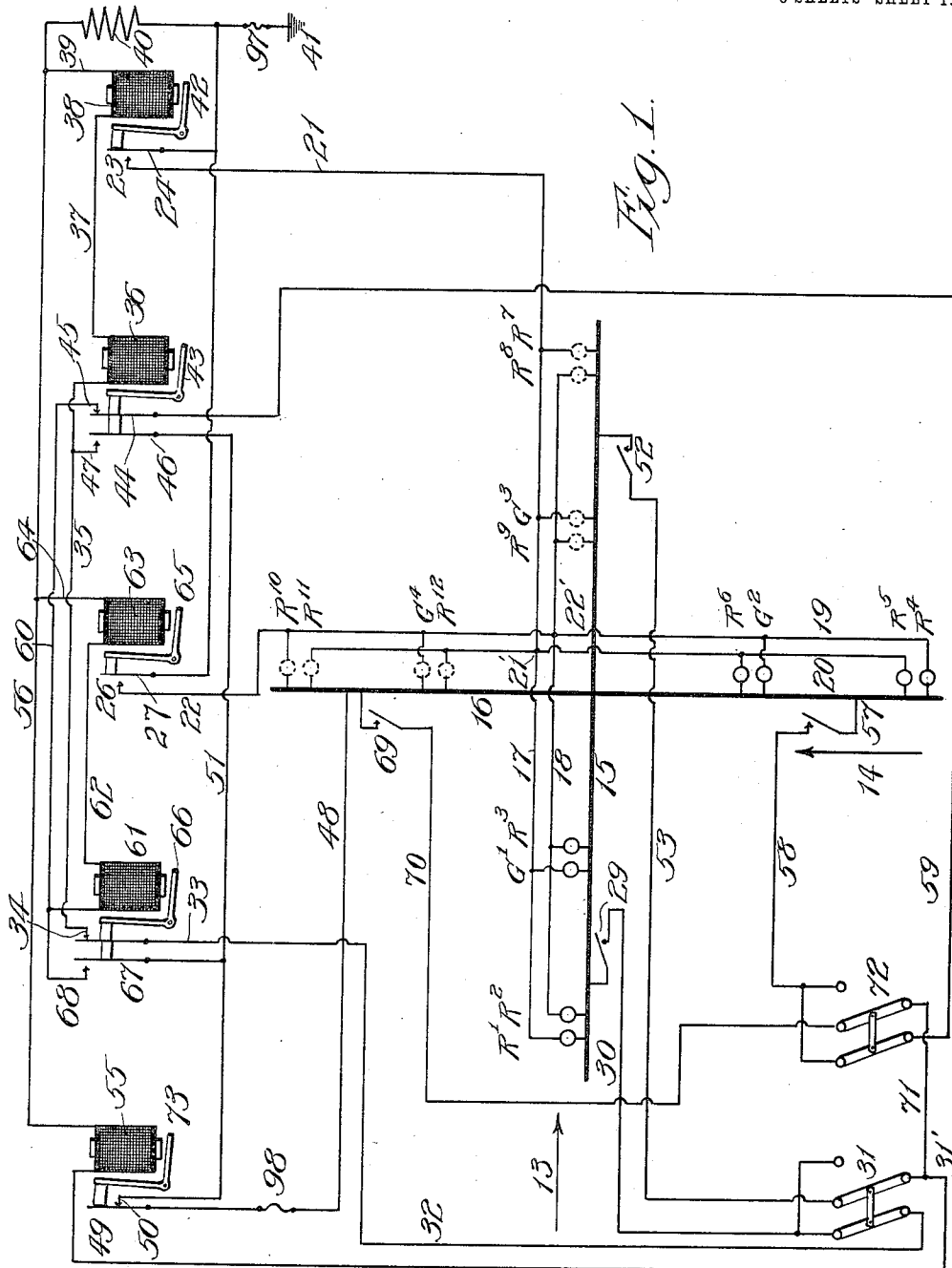


S. S. STOLP.
 BLOCK SIGNAL SYSTEM FOR ELECTRIC RAILWAYS.
 APPLICATION FILED SEPT. 4, 1908.

1,016,975.

Patented Feb. 13, 1912.

3 SHEETS—SHEET 1.



Witnesses:

John Enders
 Chas. H. Bull.

Inventor:

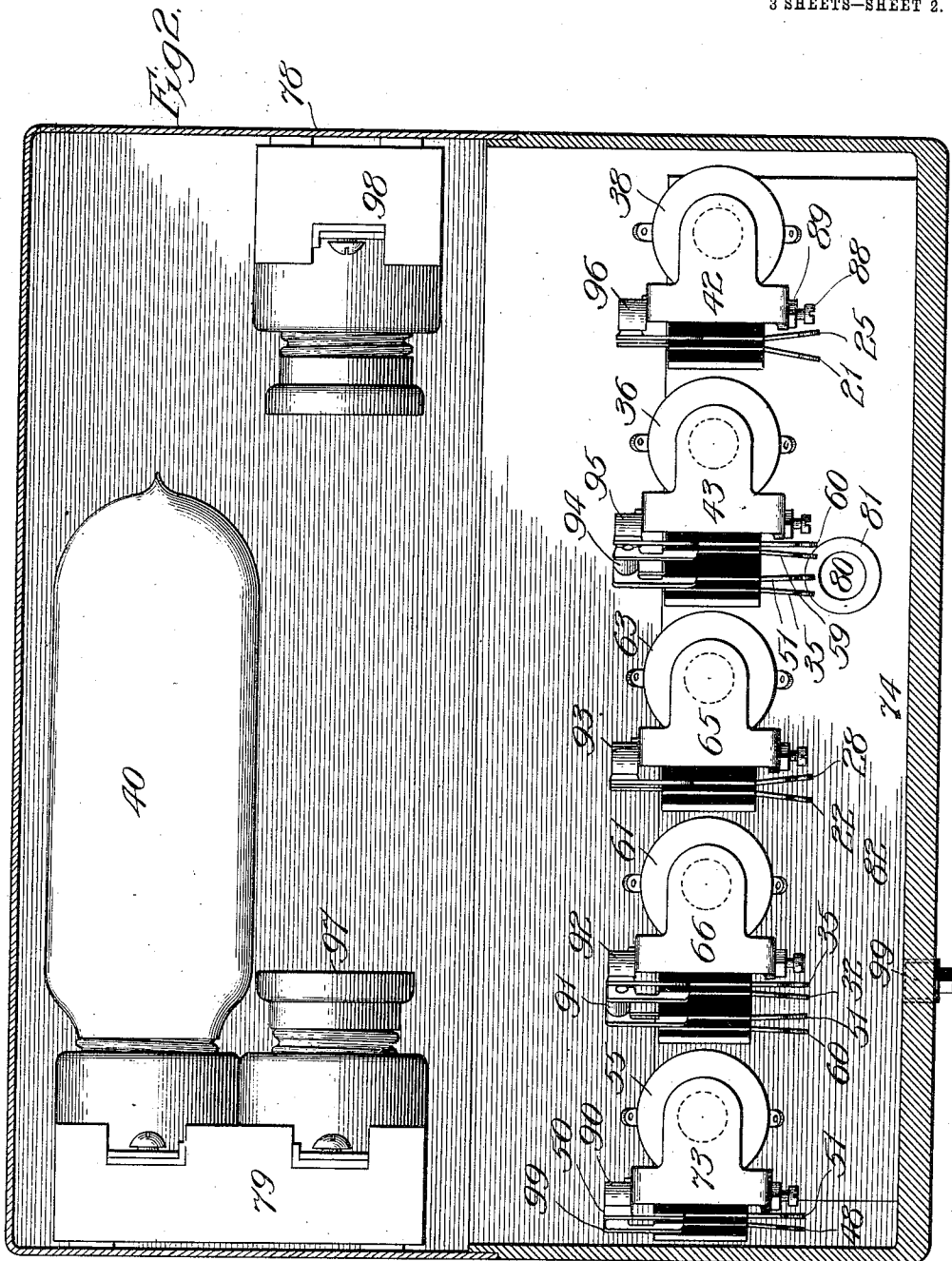
Samuel S. Stolp
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3 SHEETS—SHEET 2.



Witnesses:
 John Enders
 Chas. A. Buell

Inventor:
 Samuel S. Stulp.
 By Sheridan & Wilkinson
 Attys.

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3 SHEETS—SHEET 3.

Fig. 3.

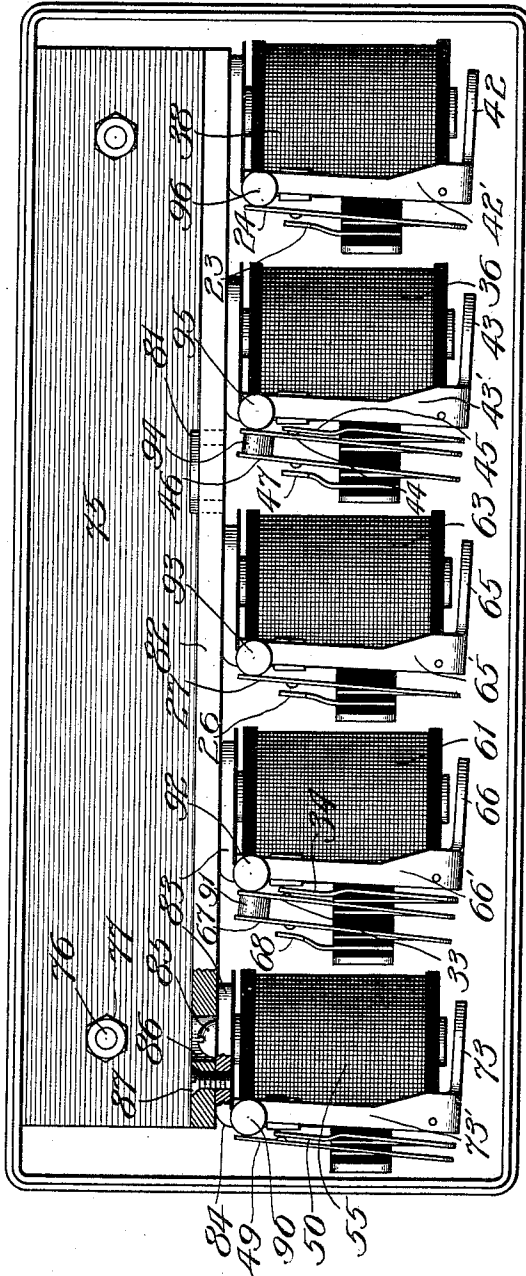
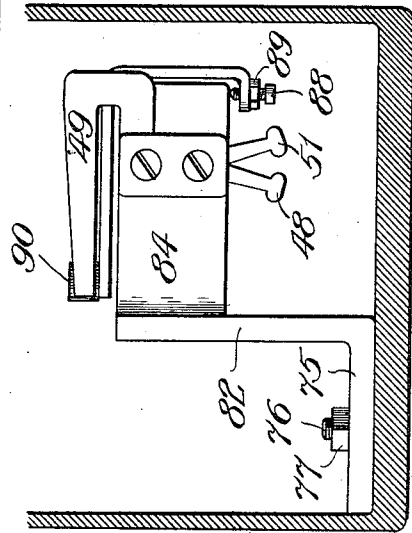


Fig. 4.



Witnesses:

John Enders
 Chas. H. Bull.

Inventor:

Samuel S. Stolp.
 By Sheridan & Wilkinson
 Attys.

UNITED STATES PATENT OFFICE.

SAMUEL S. STOLP, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO WILLIAM J. C. KENYON, OF CHICAGO, ILLINOIS.

BLOCK-SIGNAL SYSTEM FOR ELECTRIC RAILWAYS.

1,016,975.

Specification of Letters Patent.

Patented Feb. 13, 1912.

Application filed September 4, 1908. Serial No. 451,638.

To all whom it may concern:

Be it known that I, SAMUEL S. STOLP, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Block-Signal Systems for Electric Railways, of which the following is a specification.

The object of my invention is to provide a new and improved automatic block signal system for electric railways. My system is particularly adapted for use in tunnel railways where the prevailing moisture presents peculiar difficulties that have to be contended with. However, this system is adapted for use in other situations.

Referring to the drawings—Figure 1 is a diagrammatic representation showing the complete wiring for the system. Fig. 2 is an elevation of the relays employed, the box containing these relays being shown in section. Fig. 3 is a top plan view of the relays, and Fig. 4 is an end elevation of the relay support.

In the particular embodiment of my invention which I have chosen to illustrate in the drawings, I have shown my signal system applied to protect an intersection.

It will be readily apparent after following the description of this specific embodiment of my invention, that it can be varied to suit other conditions. I have shown the circuit connections arranged for traffic on each of the intersecting lines in the direction of the arrows numbered 13 and 14, but in the course of this description it will be made apparent that the direction of traffic may be readily reversed on either or both of the two lines.

The trolley wires which supply current to the electric cars are represented by the two reference numerals 15 and 16. These wires are preferably connected together as shown in Fig. 1. The red lamp R' and the green lamp G' are connected in multiple between the trolley wire 15 and the conductor 17. Beside the red lamp R' is another red lamp R^2 and beside the green lamp G' is a red lamp R^3 . These red lamps R^2 and R^3 are connected in multiple between the trolley wire 15 and the conductor 18. As shown in Fig. 1, the lamps R' and R^2 are placed at the entrance to the block and the lamps R^3 and G' are placed between the lamps R' and R^2 and the intersecting point.

There is an exactly similar arrangement of red lamps R^4 , R^5 and R^6 and a green lamp G^2 between the trolley wire 16 and the conductors 19 and 20. The conductors 17 and 20 are connected together at the point 21' and a wire 21 leads thence to the contact point 23 which is adapted to be engaged by the opposed coacting contact point 24 having a ground connection at 41. The two conductors 18 and 19 are connected together at 22' and from them the conductor 22 leads to the contact point 26 which is adapted to be engaged by the coacting contact point 27 leading to the ground connection 41. At a point intermediate between the pair of lamps R' , R^2 and the pair G' , R^3 a conductor 30 leads from the trolley wire having a trolley contactor or switch 29 placed on the trolley wire so as to be momentarily closed by the passage of a trolley wheel over the wire 15. This conductor 30 leads through the switch 31 (the function of which will be explained later), thence by the conductor 32 to the contact terminal 33, then across to the opposed coacting contact point 34 along the conductor 35, through the magnet coils 36 and 38 in series to the conductor 39 and thence through the resistance 40 to ground 41. The magnet 38 has a bell crank armature 42 which when actuated is adapted to close the contacts 23—24. The magnet 36 has a bell crank armature 43 which when actuated breaks the contact 44—45 and makes the contact 46—47.

From the trolley wire 16 a conductor 48 leads through the opposed coacting contact points 49 and 50 and thence along the conductor 51 to the contact point 46.

Across the intersection from the trolley contactor 29 is another trolley contactor 52, which is placed at the end of the block and is adapted to connect the trolley wire 15 to the conductor 53. This leads through the switch 31 and conductor 54 to the magnet coil 55 and thence along the conductor 56 through the resistance 40 to ground 41. The magnet 55 has a bell crank armature 73 which is adapted to break the contact 49—50.

A trolley contactor 57 is placed in a position to be actuated by the trolley wheel of a car entering the block along the line of the trolley wire 16, and thus connect the latter to the conductor 58. This leads through the switch 72 along the conductor

59 through the contact points 44—45, conductor 60, magnet coils 61 and 63 in series, conductor 56, resistance 40 to ground 41. The magnet 63 has a bell crank armature 5 65 which when actuated is adapted to close the contacts 26—27. The magnet 61 has a bell crank armature 66, which when actuated opens the contact 33—34 and closes the contact 67—68.

10 At the exit from the block along the line 16 a trolley contactor 69 is placed, which is adapted to connect the wire 16 to the conductor 70 and thence through the switch 72 and conductor 71 to the conductor 54 15 from which point the circuit is traced the same as has previously been done starting from the contactor 52.

Referring to Figs. 2, 3 and 4, it will be seen that the relays are placed in the metal 20 box 74 which has a hinged cover 78. A length of angle iron having the two flanges 75 and 82 (see Fig. 4) has the flange 75 bolted to the bottom of the box 74 by means of the bolts 76 and nuts 77. Preferably, 25 the bolts 76 are projecting lugs cast integrally with the box 74 and afterward threaded to receive a nut. In the cover 78 of the box is placed a fixture 79 which carries the high resistance lamp 40 and the fuse 97. The hole 80 through the flange 82 30 to the angle iron 75—82 has an insulating bushing 81 and through this hole the conductors are led to the various terminals shown in Fig. 2, these terminals being designated in Fig. 2 with the reference numerals 35 of the conductors to which they are attached. The general structure of the five magnets 55, 61, 63, 36 and 38 is the same. Each has an L-shaped piece 83—84 with the 40 magnet core attached to one arm 83 by means of the screw 85. A hole 86 in the flange 82 of the angle iron 75—82 is provided to receive the head of the screw 85. Other screws 87 are employed to attach the 45 L-shaped frame piece 83—84 to the angle iron 75—82. The extremity of the arm 84 of each L-shaped piece 83—84 has pivotally connected thereto the bell crank armature levers seen most clearly in Fig. 3 and there 50 designated as 73—73', 66—66', etc. The pivot screws 88 with lock nuts 89 pass through the bell cranks and engage the branches 84 of the L-shaped piece 83—84. The extremities of the five bell cranks carry 55 the respective insulating studs 90, 92, 93, 95 and 96, which act upon the adjacent contact points, as seen most clearly in Fig. 3. Each of the magnets 61 and 36 performs a double function, breaking one contact and simultaneously closing another. The insulating 60 spacers 91 and 94 are provided, as shown in Fig. 3, for this purpose. Fuses 97 and 98 are inserted between the system and the ground 41, on one hand, and in the conductor 48 on the other hand. The box 74

is intended to be filled with fluid insulating oil, which may be drawn off when desired by removal of the plug 99 in the bottom of the box.

Referring to Fig. 1, the operation of my 70 invention will now be described. The parts are there shown in the position which they would have if the block embracing the intersection were unoccupied. At this time all the lamps will be on open circuit. A car 75 approaching the intersection in the direction of the arrow 13 will close the contactor 29 and thus through the circuit that was traced therefrom, the magnets 36 and 38 will be energized by being connected in series 80 between the trolley wire 15 and the ground 41. The energization of the magnet 38 will cause a closure of the contact 23—24 and this will cause a current to flow through the lamps R', G', R^s and R^e in parallel from 85 the trolley wires 15 and 16 to the ground 41. Thus the operator of the car at the contactor 29 will get a green light in front of him which will be a permissive signal authorizing him to proceed on his way either 90 across the intersection or to turn at the intersection and go in the direction of the arrow 14 along the line 16. The red light R' behind this car is a warning signal to close the block and the red lights R^s and R^e are 95 also warnings to close the block along the intersecting line. The energization of the magnet 36 which also occurred when the contactor 29 was closed, opens the contact 44—45, that is, it opens the circuit leading 100 from the contactor 57 and thus makes it impossible for a car approaching along the line 16 in the direction of the arrow 14 to set the signals against a car already having the right of way through the block. 105 Further, the energization of the magnet 36 closes the contact 46—47. This has the effect of completing the circuit from the trolley wire 16 through the conductor 48, contacts 49—50, conductor 51, contacts 46—47 110 and thence through the two magnet coils 36 and 38 in series to ground 41. Thus it happens that when the trolley contactor 29 opens, nevertheless, current continues to flow through the magnet coils 36 and 38. 115 Stated briefly, the closure of the contact 29 energizes magnets 36 and 38 and the magnet 36 by its action establishes a permanent connection with the line 15—16 through the contact 46—47 and thereby the magnets 36 120 and 38 continue to be energized after the contact 29 is broken.

The parts remain in the condition that has now been described while the car continues on from the contactor 29 across the 125 block. Eventually, the contact 52 is closed, thus connecting the trolley wire through the circuit that has already been traced so as to energize the magnet coil 55. This causes the contact 49—50 to break and thus the two 130

magnets 36 and 38 are deenergized. The lamp circuit is opened at 23—24, thus extinguishing all the lamps and the parts associated with the magnets 36 are restored to their normal positions.

If instead of continuing straight ahead along the line 15 the car had turned from the line 15 to go along the line 16 in the direction of the arrow 14, the contact 69 would have been closed instead of the contact 52. The effect would have been exactly the same, for the conductors leading to these two contacts meet at the point 31' and thence a common conductor leads through the magnet coil 55 to ground 41.

The operation for a car passing along the line 16 in the direction of the arrow 14 is exactly similar to that which has already been described and hence it will be merely summarized briefly. Closure of the contact 57 energizes magnets 61 and 63, thus closing the lamp circuit at 26—27 and throwing on the four lamps R^4 , G^2 , R^2 and R^3 ; also, the contact 33—34 is broken so that it is impossible for a car, by closing the trolley contact 29, to affect the signals; and, further, contact 67—68 is closed, thus putting the two coils 61 and 63 permanently in circuit between the conductor 48 and ground 41. When the advancing car reaches the trolley contactor 69 (or 52) it closes the same and thereby energizes magnet 55, breaking the contact 49—50, deenergizing the coils 61 and 63, thus opening the lamp circuit at 26—27 and restoring the parts associated with the relay coil 61 to their normal position.

In case two cars approach the respective "on" contactors 29 and 57 at nearly the same time, the operation of the system would be as follows: Suppose the contactor 29 were closed a moment before the contactor 57,—then the operator of the car running along the line 16 in the direction of the arrow 14 would get the red light R^6 in front of him because the illumination of this light follows immediately from the closure of the contactor 29. Moreover, he would fail to get the permissive green light G^2 , because his own "on" signal circuit has been broken at 44—45 as a consequence of the closure of the contact 29. Therefore, he should come to a stop before reaching the intersection and even after the other car has entirely left the block, he would be obliged to back up so as to actuate his trolley contactor 57 in order to get the permissive green signal G^2 that would authorize him to proceed through the block. I desire to call attention to the fact that with this signaling system, it is not necessary to instruct the operators of the cars as to which line has the right of way at an intersection. It is a practical impossibility that the two "on" contactors 29 and 57 shall be closed

at exactly the same instant, and thus the system itself determines with the utmost precision which car reaches the block first and therefore has the right of way through the block.

In case of any break down by which the signal lamps fail to operate, the green lamps would fail to work the same as the red lamps. Thus, the operator of the car would be notified that the system was out of order and would be expected to proceed only with the utmost caution and to immediately report the trouble.

Symmetrically placed on the two lines with respect to the lamps that have already been described are the red lamps R^7 , R^8 , R^9 , R^{10} , R^{11} , R^{12} and the green lamps G^3 , G^4 . This is shown clearly in Fig. 1. But I have shown these lamps in dotted lines to indicate that they are loosened or removed from their sockets or in any manner disconnected electrically. In case it is desired to reverse the direction of traffic on either or both of the lines 15 and 16, the procedure would be as follows. Suppose, for example, that it is desired to reverse the direction of traffic on the line 15, then the lamps R^7 , R^8 , R^9 and G^3 would be disconnected and the lamps R^7 , R^8 , R^9 and G^3 would be connected. At the same time the switch 31 would be shifted and the system would now be ready for operation with traffic on the line 15 in reversed direction. This fact can readily be verified, for it is obvious that the signal lamps will be properly arranged for this purpose. An inspection of Fig. 1 also shows that by the shifting of the switch 31 the trolley contactor 52 has taken the place of the trolley contactor 29 in its connection to the conductor 32 of the "on" signal circuit. Further, it will be seen that the contactor 29 has taken the place of the contactor 52 in connection to the point 31' from which the "off" signal circuit leads. Further, it will be seen that the operative connections for traffic along the line 16 have not been affected by this change.

In an exactly similar manner traffic may be reversed on the line 16 by connecting in the lamps R^{10} , R^{11} , R^{12} and G^4 and disconnecting the lamps R^4 , R^5 , R^6 and G^2 and also shifting the switch 72.

My system makes no use of insulated rail sections but the entire system for an intersection is operated by four trolley contactors. Not only is the arrangement such that freedom from break down is practically assured, but the system gives its own warning in case of any trouble. If for any reason it becomes desirable to reverse traffic on either or both of the intersecting lines this can be done in a very brief time and by a person who does not understand the system of wiring employed. All the relays, the resistance 40, the fuse and the switches 31 and 72

can be placed at any convenient point, preferably at the intersection. The relays are immersed in insulating oil which protects them from the evils due to dampness. As stated at the beginning of this specification, my signal system is especially adapted for use in connection with tunnel railways, though its utility and advantages are by no means limited to tunnel service. The extreme dampness in the tunnels is a disadvantage that requires special adaptation to overcome. By immersing the relay in oil, it is protected in the following ways: (1) All the parts are effectively insulated; (2) they are protected from damage by moisture; (3) the moving parts of the relay are lubricated; (4) the oil cools the relay if it should tend to become heated; (5) the oil quenches any arc that might form between the contact points; and (6) finally, it excludes the air, and thereby prevents oxidation of the contact points. For all these purposes it is most desirable to use an oil having a high spark point.

It is obvious that my system can readily be employed to protect a block on a single line by simply omitting those parts which are shown in Fig. 1 in connection with the intersecting line.

I claim:

1. A railway block signal system to protect two intersecting tracks in the neighborhood of their intersection comprising warning signals adjacent to both tracks, a permissive signal adjacent to one track between the warning signal and the intersection point, mechanism located between that warning signal and the permissive signal that are adjacent to the same track, said mechanism being adapted to be actuated by a car approaching the intersection, apparatus to energize all said signals simultaneously, means to render said apparatus operative, and operating connections from said mechanism to said means.

2. In a railway block signal system, a signal actuating circuit, two relays, one of them being adapted to close said circuit, another circuit including both relays in series and having a switch adapted to be closed by a car entering the block and a shunt around said switch, the second relay being adapted to close said shunt.

3. In a railway block signal system, a signal actuating circuit, two relays, one of them being adapted to close said circuit, another circuit including both relays in series and having a switch adapted to be closed by a car entering the block, a shunt around said switch, the second relay being adapted to close said shunt, and a circuit including a third relay adapted to open said shunt, said last named circuit having a switch adapted to be closed by a car leaving the block.

4. A railway block signal system to protect two intersecting tracks in the neighborhood of their intersection, comprising a red lamp adjacent to one track, a green lamp between said red lamp and the point of intersection, another red lamp adjacent to the intersecting track, apparatus to energize said signal lamps, and means located between the first mentioned red lamp and the green lamp to be actuated by a car to govern the apparatus to set all said lamps.

5. A railway block signal system to protect two intersecting tracks, comprising two signal circuits, each having branches in multiple along the two intersecting tracks, switches adapted to be actuated by cars approaching the intersection along the respective tracks, means actuated by said switches to close respective signal circuits, permissive signals adjacent to each track, warning signals adjacent to each track, each said circuit including a permissive signal adjacent to one track and a warning signal adjacent to the other track.

6. A railway block signal system to protect an intersection, comprising two signal circuits, each circuit including a permissive signal on one track and a preventive signal on the other track, relays to close the respective circuits, relay actuating circuits with switches adapted to be closed by approaching cars on the respective tracks, and additional relays in said relay actuating circuits each of them being adapted when actuated to open the other relay actuating circuit.

7. A railway block signal system to protect an intersection comprising two sets of signals adapted respectively to give a right of way on either track, two respective circuits to actuate the signals, relays to close said circuits, two actuating circuits for the respective relays, each actuating circuit having a switch therein adapted to be closed by a car entering the block, and means whereby the closure of one such circuit shall open the other circuit.

8. A railway block signal system to protect two intersecting tracks in the neighborhood of their intersection comprising two signal circuits, one for each track, respective relays to close said circuits, other relays to open said circuits, relay actuating circuits, each including a closing relay for one signal circuit, and an opening relay for the other actuating circuit, and switches for said relay actuating circuits adapted to be closed by a car entering the block.

9. A railway block signal system to protect an intersection comprising two signal circuits adapted to permit traffic on the respective tracks, respective signal relays for said circuits, actuating circuits for said signal relays, each having a switch adapted to be closed by a car entering the block, shunts adapted to be closed around each said switch,

each signal relay having in series therewith another relay adapted to open the circuit of the other signal relay, and to close a shunt around the switch in the circuit of its associated signal relay.

10. A railway block signal system to protect an intersection comprising signal circuits adapted to permit traffic on the respective tracks, relays to close the respective circuits, relay actuating circuits therefor with switches adapted to be closed by cars entering the block, shunts adapted to be closed around the respective switches, means actuated by a flow of current in each relay actuating circuit to establish a shunt around the switch in said circuit, and means adapted to be actuated by cars leaving the blocks to open said shunt.

11. In a railway block signal system to protect two intersecting tracks in the neighborhood of their intersection, two sets of signals adjacent to the tracks, apparatus to energize said signals, means to actuate the apparatus so as to energize the signals, other means to actuate the apparatus so as to release the signals, and means to interchange the connections of the actuating and releasing means.

12. A railway block signal system to protect an intersection, comprising sets of signals adapted for traffic in each direction along each track, circuits for said signals, relays to control the signal circuits, circuits to actuate said relays, switches in said last

named circuits at the entrance and at the end of each block, and means to interchange the connections of said switches on each track.

13. A railway block signal system to protect an intersection, comprising two signal circuits, branches extending from each circuit along each way, switches at the entrances and at the ends of the blocks on the two tracks, relays to actuate the two signal circuits, actuating circuits leading to the relays, and means to connect said actuating circuits to said switches alternatively so as to adapt the system for traffic in either direction on either track.

14. A railway block signal system to protect an intersection comprising signals adapted to be operatively connected up for traffic in either direction along each track, circuits to actuate said signals, relays to open and close said circuits, circuits to actuate the respective relays, switches adapted to open and close said last mentioned circuits at the ends of the blocks on each track, and reversible means to connect said switches to said relays so as to adapt the system for traffic in either direction along either track.

In testimony whereof, I have subscribed my name.

SAMUEL S. STOLP.

Witnesses:

ANNA L. WALTON,
LILLIAN A. KIBBY.