R. W. TAYNTON.

BLOCK SIGNAL SYSTEM.

APPLICATION FILED OCT. 19, 1908.

925,611.

Patented June 22, 1909.

3 SHEETS—SHEET 1.

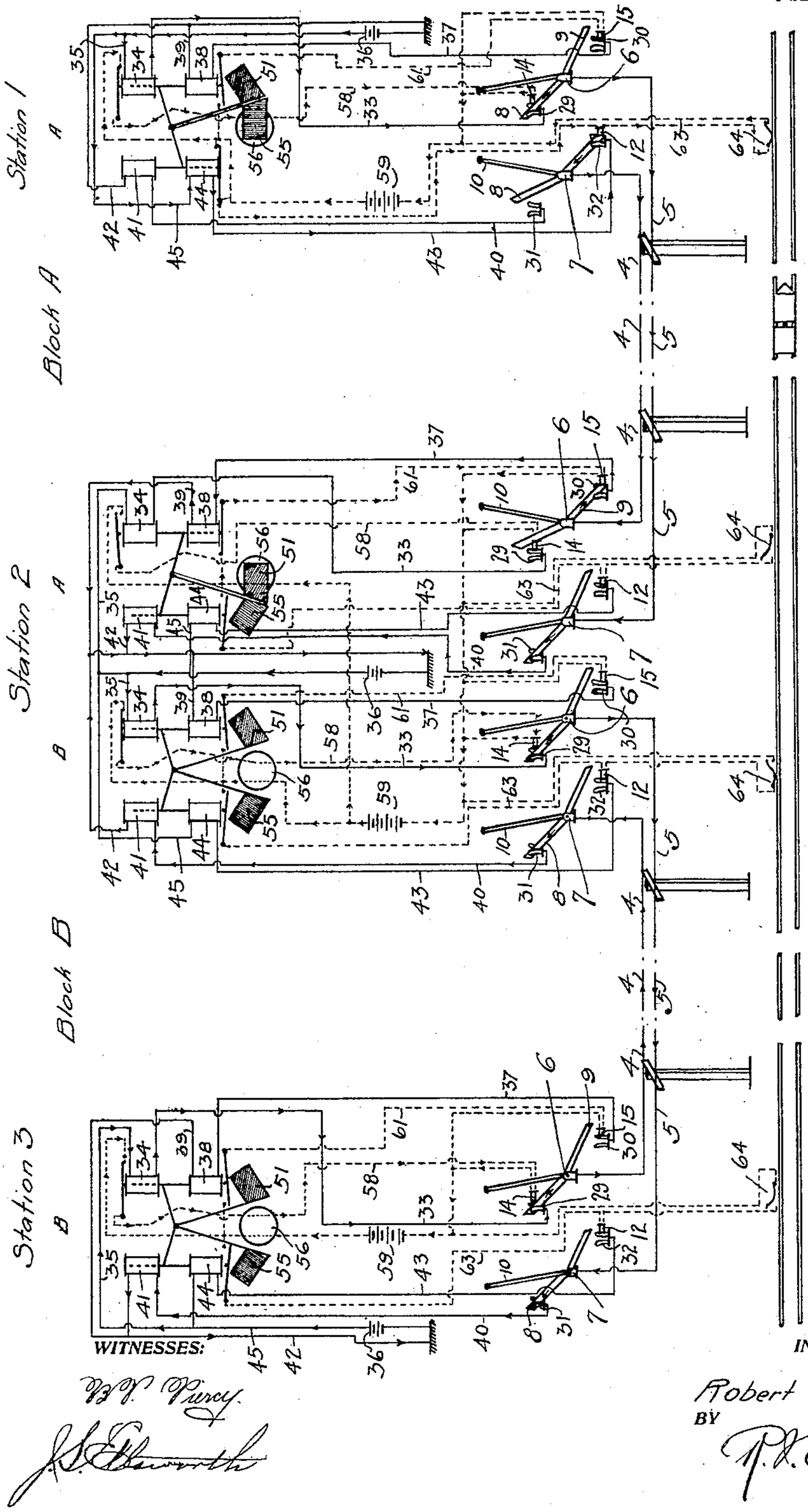

Fig. 1.

WITNESSES:

W. F. Purcy.

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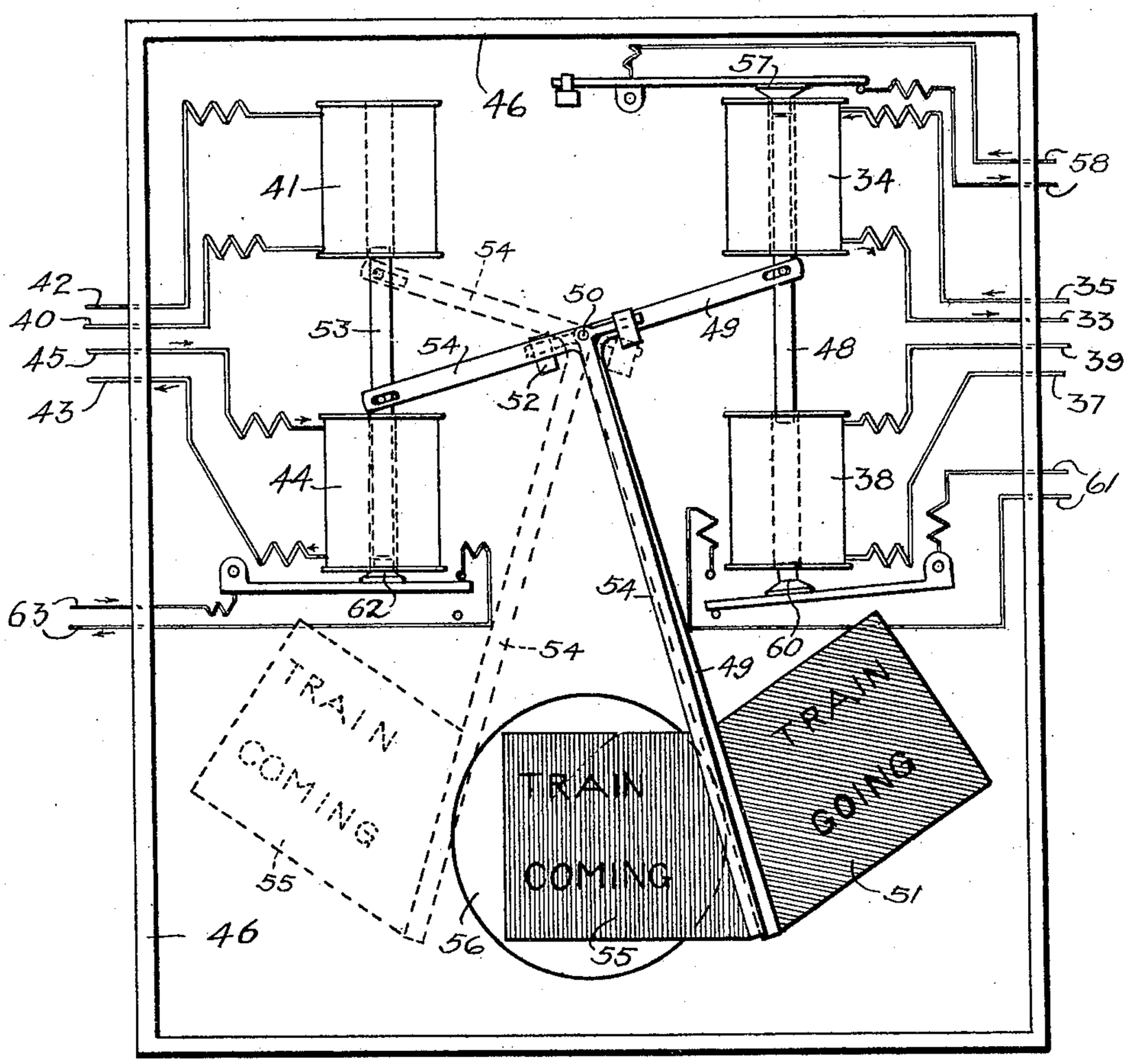

Fig. 2

Fig. 3

Fig. 4.

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6 SHEETS—SHEET 3.

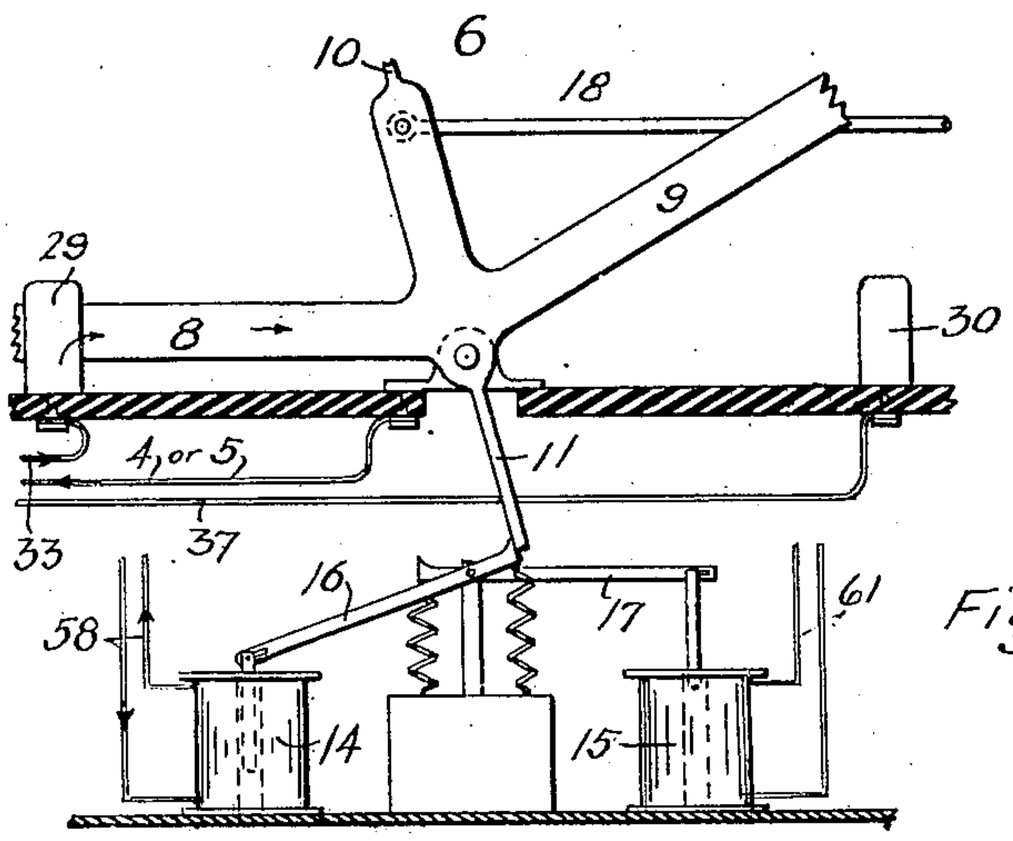

Fig. 5

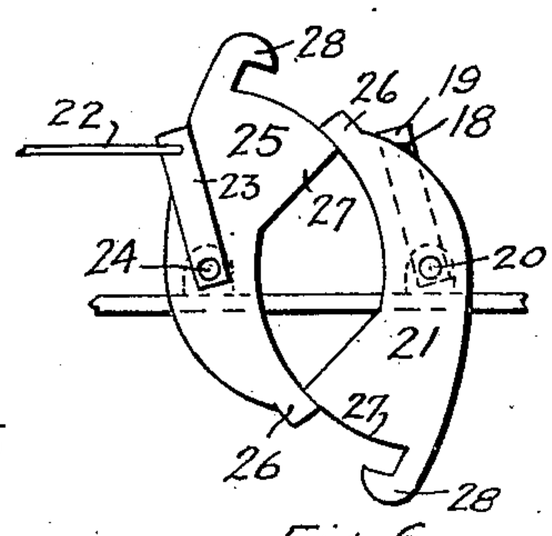

Fig. 6

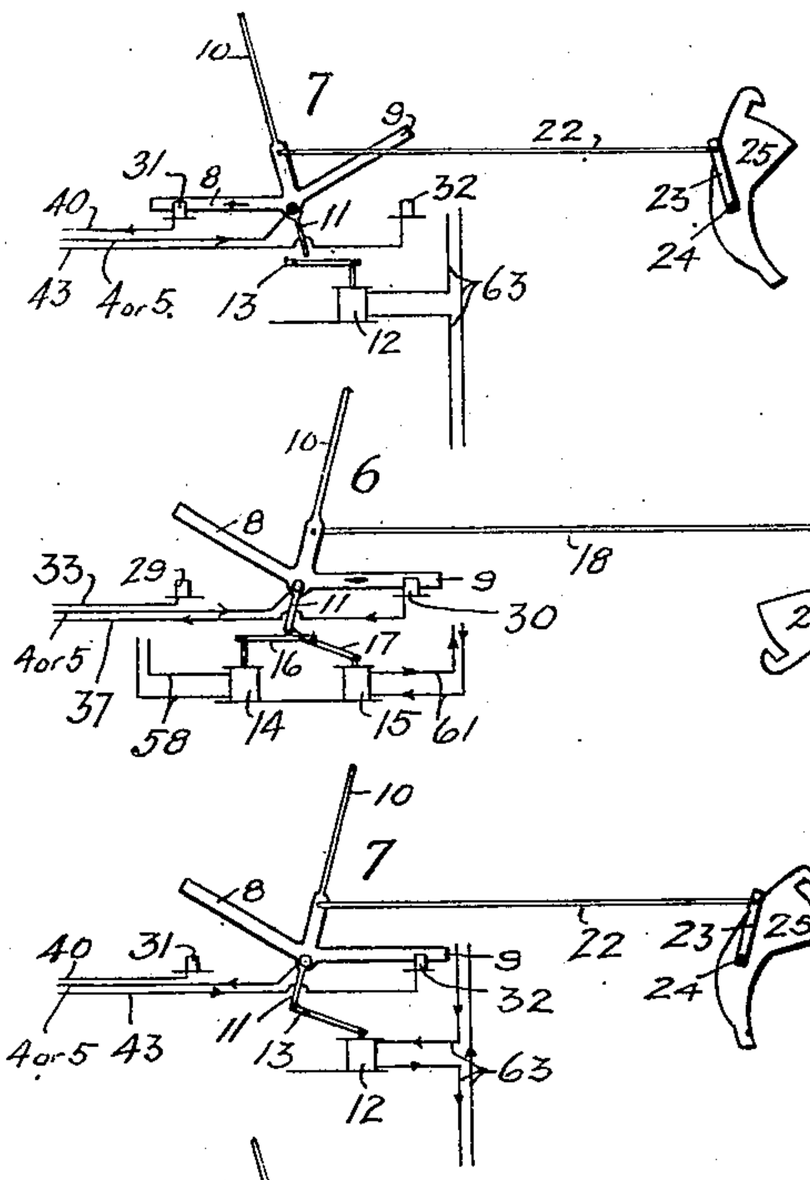

Fig. 7

Fig. 8.

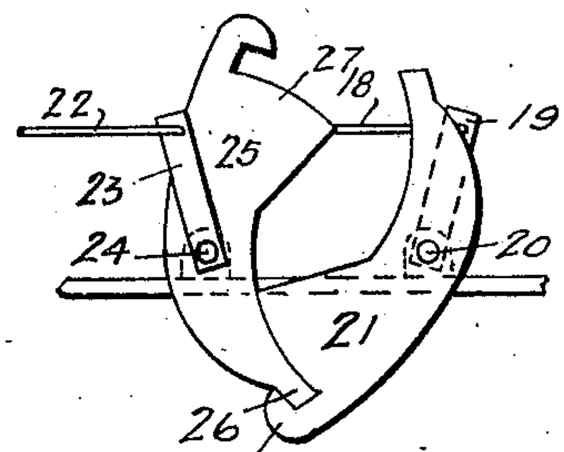

Fig. 9

Fig. 10.

Fig. 11

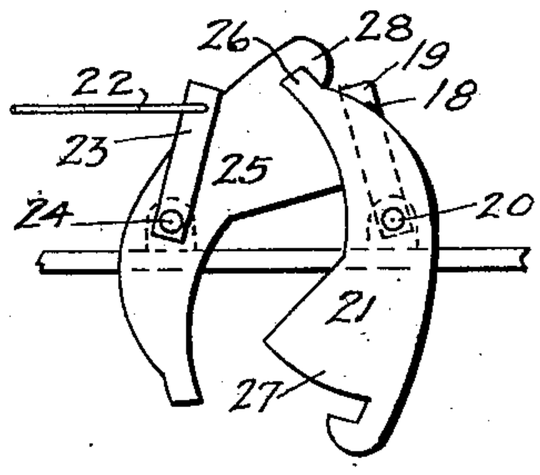

Fig. 12

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UNITED STATES PATENT OFFICE.

ROBERT W. TAYNTON, OF TACOMA, WASHINGTON.

BLOCK-SIGNAL SYSTEM.

No. 925,611. Specification of Letters Patent. Patented June 22, 1909.

Application filed October 19, 1908. Serial No. 458,513.

To all whom it may concern:

Be it known that I, ROBERT W. TAYNTON, a citizen of the United States of America, residing at Tacoma, in the county of Pierce and State of Washington, have invented certain new and useful Improvements in Block-Signal Systems, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to devices for controlling the operation of trains and has for its objects to provide means for safeguarding the trains against errors or carelessness or inefficiency of the men operating the controlling apparatus, in that both operators at the ends of a block must coöperate in allowing a train on the block, and the receiving operator controls the sending operator, and when a block has once been set to allow a train thereon it cannot be released to allow any other train in either direction until the first train has passed off therefrom since all the controlling apparatus is automatically locked in the position for allowing said train to pass thereon.

My invention as herein illustrated is intended to be operated in connection with an interlocking semaphore system of signals whereby the train crew are given orders and also in connection with suitable safety switch apparatus.

The apparatus is arranged for the control of a single track line of railroad and is illustrated in the accompanying drawings, in which,

Figure 1 is a diagrammatic representation of the apparatus controlling two blocks of railroad, showing one of said blocks clear while the other is occupied by a train thereon; Fig. 2 is a front view (with cover removed) of the indicator located in the controlling tower, one of said indicators being provided for each end of each block, and the parts illustrated in this view are shown in their positions when a train is approaching the tower; Fig. 3 is an exterior view of said indicator showing the index thereof in the position assumed when a train is receding from the tower; and Fig. 4 shows the indices in the positions assumed when the block is clear; Fig. 5 is a view of a portion of the sending switch controlling one of the circuits and in the position assumed thereby when the line is clear or when a train is approaching, and electrically locked in said position; Fig. 6 is a side view of the mechanical interlocking tumblers showing them in the positions assumed thereby when the receiving and sending switches are both set for line clear, wherein neither tumbler locks the other; Figs. 7 and 8 are diagrammatic views showing respectively the receiving and sending switches, and their tumblers, in the positions assumed when a train is receding; wherein the receiving switch is not locked by the electric lock, while the sending switch is locked thereby; and Fig. 9 is a view similar to Fig. 6 wherein the tumblers are in the same positions as in Figs. 7 and 8 and wherein the tumbler of the receiving switch is mechanically locked by the tumbler of the sending switch; Figs. 10, 11 and 12 are similar to Figs. 7, 8, and 9 respectively except that the parts therein are in their positions for receiving a train on the block wherein both switches are locked electrically and the sending switch is locked mechanically.

Similar characters of reference refer to similar parts throughout the several views.

Referring now to Fig. 1 it is seen that two blocks A and B are shown between stations 1, 2 and 3 and that a single track extends therebetween. Two telegraph wires 4, 5 extend between the stations, being connected to the circuit controlling switches therein in the hereinafter described manner. Before proceeding with a detailed account of the instruments, however, I shall point out that the instruments in the stations are similar (are duplicates in fact) and that therefore a description of one will be understood to apply to all, and that therefore they will all be similarly indicated by corresponding numerals or letters of reference, but that where, in describing their action under a certain set of circumstances, I have to call attention to the block and station in which the part being mentioned is located, I shall do so by suffixing in parentheses to the reference numeral, the block letter and station number; for instance, the part 12 in the instruments for block B, in station 2, will be indicated "part 12 (B.2)" while the same part in the instruments for block B, in station 3, will be indicated "part 12 (B.3)". Similarly the telegraph wires for block A will be described as 4 (A) and 5 (A) while those of block B will be described as 4 (B) and 5 (B).

One end of the line wire 4 is connected in one station to the pivot of the electric sending switch 6, and the other end thereof is

connected in the other station to the pivot of the electric receiving switch 7; and the ends of the line wire 5 are similarly connected to the receiving and sending switches 7 and 6 respectively in the same stations.

Referring principally to Figs. 1 and 5 it is seen that the switches 6 and 7 each consist of a pair of flat arms 8 and 9 arranged about the pivot in such manner that when one arm 8 is thrown into contact with a suitable terminal the other arm 9 is out of engagement with its terminal. A handle 10 is formed in convenient position so that said switch may be readily operated. An extension 11 is also provided in such place as to be engaged by one or the other of a pair of electrically operated stops or lock bars in the case of the sending switch 6, while in the case of the receiving switch 7 there is only one of the said stops (Figs. 7 and 10). The electric lock for the receiving switch 7 consists of a solenoid 12 adapted to draw a plunger or core toward it and thus turn the lock bar 13 engaged thereby on its pivot in such manner that its other end will engage the extension 11 to prevent the switch being moved from the receiving position (shown in Fig. 10) so long as a current is energizing the solenoid 12. The electric lock for the sending switch 6 (Fig. 5) consists of two independent solenoids 14 and 15 actuating independent lock bars 16 and 17 respectively which are pivoted centrally under the pivot of the switch 6 in such manner that when the switch is in the "line clear" or receiving position (Figs. 5 and 11) the solenoid 14 actuates the lock bar 16 and draws it into position to engage and lock the extension 11 of the switch so that it cannot be moved so long as the solenoid 14 is energized; and so that when the switch is in the sending position (Fig. 8) the solenoid 15 actuates the lock bar 17 to lock the switch so that it cannot be moved out of this position so long as the solenoid 15 is energized. The solenoids 12, 14 and 15 are similar in all respects and actuate the lock bars 13, 16 and 17 against the action of some force, such as a spring or weight, which withdraws the said lock bar when the solenoid controlling it is no longer energized. In Fig. 1 the solenoids are shown out of their proper positions, each one being adjacent to the terminal in contact with which it locks the arm of the switch; this is done to simplify the drawing which is intended primarily to show the electric circuits.

The switch 6 is connected, by means of a rod 18, to an arm 19 secured on a rocking shaft 20 on which the tumbler 21 is mounted. The switch 7 is similarly connected by the rod 22, arm 23, and rocking shaft 24, to the tumbler 25. The shafts 20 and 24 are suitably mounted parallel with each other and the tumblers 21 and 25 thereon are in the same plane. The tumblers are similar in shape but are mounted in the shafts in inverted positions and are of such form and dimensions that they coöperate with each other in the following manner:—Each tumbler consists of a tail part 26 whose inner surface is curved so that when the tumbler is in its "line clear" or unlocked position (Fig. 6), the said surface is concentric with the shaft of the other tumbler; and also of a shoulder 27 which engages the said tail 26 in said unlocked position and which has a curvature of equal radius about the center of the shaft on which said tumbler is mounted. Each tumbler is also provided with a nose or hook 28 which extends out from the shoulder 27 and which engages the tail 26 of the other tumbler when it (the first tumbler) is rocked into its locking position (Figs. 9 and 12). It will be seen from the drawings that, when the switch handles 10 are both pushed to the left, the tumblers are in the unlocked position shown in Fig. 6 and the sending switch 6 (Figs. 5 and 11) is locked by the bar 16 controlled by the solenoid 14 while the receiving switch 7 (Fig. 7) is not locked either mechanically or electrically. Also, that if the receiving switch 7 is thrown over to the right (Fig. 10) it locks the sending switch 6 mechanically (Fig. 12) and is itself locked electrically by the bar 13 actuated by the solenoid 12 (Fig. 10). Also, that when the switches are thus locked it will be impossible to alter them while the solenoid 12 is energized. Also, that if the sending switch 6 is thrown over to the right (Fig. 8) it locks the receiving switch 7 mechanically (Fig. 9) and is itself locked electrically by the bar 17 actuated by the solenoid 15 (Fig. 8). Also, that when the switches are thus locked it will be impossible to alter them while the solenoid 15 is energized.

Referring now to the electric circuits between the switches 6 and 7 and the indicator. One pair of switches 6 and 7 is provided for each indicator instrument. The switch 6 has two terminals 29 and 30, and the switch 7 has two terminals 31 and 32. The wire 33 joins the terminal 29 with the upper right-hand solenoid 34 and the wire 35 connects the said solenoid 34 to the line battery 36, the other terminal of which is grounded. The wire 37 joins the terminal 30 with the lower right-hand solenoid 38 and the wire 39 connects the said solenoid 38 to the ground. The wire 40 joins the terminal 31 with the upper left-hand solenoid 41 and the wire 42 connects the said solenoid 41 to the ground. The wire 43 joins the terminal 32 with the lower left-hand solenoid 44 and the wire 45 connects the said solenoid 44 to the line battery 36, the other terminal of which is grounded. Thus it will be seen that the solenoids 38

and 41 in each indicator are grounded and that the solenoids 34 and 44 are connected to the line battery in that station. Therefore if the switches 6 and 7 are both thrown over to the "line clear" positions (as in block B, Fig. 1) so that the arms 8 thereof engage respectively the terminals 29 and 31 then a current of electricity will pass from the line battery 36 (B.2) by way of wire 35 (B.2), solenoid 34 (B.2), wire 33 (B.2), terminal 29 (B.2), arm 8 (B.2), pivot of switch 6 (B.2), line wire 5 of the block B to pivot of swith 7 (B.3) of the other station of the same block B, arm 8 (B.3), terminal 31 (B.3), wire 40 (B.3), solenoid 41 (B.3), and wire 42 (B.3 to the ground. Similarly another current of electricity will pass from the line battery 36 (B.3) of the other station over a precisely similar course, by way of the line wire 4, through the solenoid 41 (B.2) to the ground. But if the sending switch 6 is thrown in one station and the receiving switch 7 is thrown in the other station we have a condition illustrated in block A (Fig. 1) in which the current passes from the receiving station (A.1) to the sending station (A.2) over both line wires 4 (A) and 5 (A) as follows:—It leaves the line battery 36 (A.1) by the wire 45 (A.1), solenoid 44 (A.1), wire 43 (A.1), the terminal 32 (A.1), arm 9 (A.1), pivot of switch 7 (A.1), line wire 4 (A), pivot of switch 6 (A.2), arm 9 (A.2), terminal 30 (A.2), wire 37 (A.2), solenoid 38 (A.2), and wire 39 (A.2) to the ground; and also from the same battery 36 (A.1) by the wire 35 (A.1), solenoid 34 (A.1), wire 33 (A.1), terminal 29 (A.1), arm 8 (A.1), pivot of switch 6 (A.1), line wire 5 (A), pivot of switch 7 (A.2), arm 8 (A.2), terminal 31 (A.2), wire 40 (A.2), solenoid 41 (A.2) and wire 42 (A.2) to the ground.

It will be noted that the course of the current in the latter part of the above description is the same as the course of the current in a "line clear" case. It will also be noted that the switch 6 (A.1) is locked mechanically by switch 7 (A.1) (Fig. 12) and also electrically by solenoid 14 (A.1) (Figs. 5 and 11) while switch 7 (A.1) is locked electrically by solenoid 12 (A.1) and is not otherwise locked; and also that switch 6 (A.2) is locked electrically by solenoid 15 (A.2) (Figs. 5 and 8) and locks switch 7 (A.2) mechanically (Fig. 9) and that said switch 7 (A.2) is not otherwise locked. If the current energizing the solenoid 12 (A.1) be broken, then switch 7 (A.1) may be thrown back to the "line clear" position, and if this be done the circuit of the line wire 4 (A) is broken and both ends thereof are grounded; this will result in the demagnetization of the solenoids 44 (A.1) and 38 (A.2); the break in this circuit also results (as hereinafter described) in the demagnetization of the solenoid 15 (A.2) thus releasing the electric lock of the switch 6 (A.2) and allowing it to be thrown back to its "line clear" position, and if this be done the tumbler secured thereto will release the tumbler secured to the switch 7 (A.2) and the switches for block A will make the connections above described for "line clear" on block B.

Referring now to Figs. 2, 3 and 4 the indicator comprises a box 46, preferably mounted vertically and having an indicator window 47, in its front face, through which the index is observed. Within this box 46 are mounted the four solenoids 34, 38, 41 and 44, the solenoids 34 and 41 being vertically over the solenoids 38 and 44. They are all arranged with their magnetic axes vertical and the pairs are similar in all respects. The pair of solenoids 34 and 38 is provided with a single armature consisting of the soft iron bar 48 which passes from one to the other. The index lever 49 engages the bar 48 at its middle point and is pivoted at 50 and carries the index card 51 at such point thereon as to swing in front of the indicator window 47 when the bar 48 is drawn downward by the solenoid 38, but to swing away therefrom when it is drawn upward by the solenoid 34 as is shown in Fig. 2. The index card 51 carries the legend "train going" and is colored green. The index lever 49 is counterbalanced by a weight 52. Similarly the solenoids 41 and 44 have an armature bar 53 engaging an index lever 54 pivoted at 50 and carrying an index card 55 in a position similar to the card 51. The card bears a legend "train coming" and is colored red. The lever 54 is counterbalanced by a weight similar to the weight 52. I prefer to place the pivot 50 between the pairs of solenoids so that one card will swing to one side of the window 47 and the other card will swing to the other side thereof. A fixed index card 56 is mounted opposite the indicator window 47 and in a plane to the rear of the planes of the cards 51 and 55. This card 56 bears the legend "line clear" and is colored white. This card 56 cannot be seen if either of the other cards 51 or 55 is swung into indicating position at the window 47. The operation of this indicator will be readily understood as follows:—Only one solenoid of each vertical pair can be energized at a time, and whichever solenoid is energized will attract the armature bar in its direction and this bar will cause the index lever engaging it to swing on its pivot. Now if either of the upper solenoids is magnetized it will cause the card controlled thereby to be withdrawn from the indicator window, while if either of the lower solenoids is energized it will cause its card to swing in front of the indicator window.

When the block has a double track I operate one track with one line wire 4 and the other track with the other line wire 5 and divide the indicator in the center so that one index card will be shown at one indicator window while the other index will be shown at the other indicator window. In this case I do away with the mechanical locks or tumblers above described, as there is no need of them.

A counterbalanced relay armature 57 is pivoted adjacent to the solenoid 34 so that when the solenoid is energized the said armature will complete a relay circuit 58, but when the solenoid is demagnetized the said relay circuit will be broken. The relay circuit 58 extends from the relay battery 59, through the armature 57, the solenoid 14 (which locks switch 6 in the "line clear" position) and back to the battery. Another relay armature 60 is mounted adjacent to the solenoid 38 so that when the solenoid is energized the said armature 60 will complete the relay circuit 61, which is otherwise broken by this armature. The circuit 61 also extends from the battery 59, through the armature 60, the solenoid 15 (which locks switch 6 in sending position) and back to the battery. A third relay armature 62 is mounted adjacent to the solenoid 44 so that when the solenoid is energized the said armature 62 will complete the relay circuit 63, which is otherwise broken by this armature. The relay circuit 63 extends from the battery 59, through the armature 62, the solenoid 12 (which locks the switch 7 in receiving position) the train-break 64, and back to the battery. The train-break 64 consists of any of the well-known devices which are set manually but broken by a train passing thereover in the proper direction. In this case I set the train-break by means of the usual visual semaphore apparatus.

It is evident from the foregoing that, once a train has been admitted to a block, the signals and switches thereon cannot be altered until said train passes over the train-break 64 thus breaking the circuit 63, and unlocking switch 7. Also, if the line is clear, a train cannot be admitted to a block by the sending operator because his sending switch 6 is locked electrically by the solenoid 14 which is controlled by the current in the line wire from the receiving switch 7 at the other end of the block, hence the sending operator must request the receiving operator to throw his receiving switch 7 (which is not locked) and when he does so he breaks the circuit in solenoid 34, releasing the relay armature 57, breaking the relay circuit 58 and demagnetizing solenoid 14, thus releasing the sending switch 6 which may then be thrown to allow the train on the block. When this switch 6 is thrown the current in the wires 4 and 5 causes the sending switches in both stations and the receiving switch in the receiving station to lock the switches in position, while the receiving switch is locked mechanically (Figs. 7, 8 and 9).

From the foregoing description it will be seen that the sequence of operations which takes place while a train is passing through two consecutive blocks is as follows:—Supposing a train to be in block A and running from station 1 to station 2, and considering the sequence of operations in block B. The operator in station 2, having accepted the train in block A, and being informed that the train approaches his station 2, immediately signals on block B to the operator of station 3, informing him that a train is approaching station 2 and asking the said operator (station 3) to accept the train on block B. It must be remembered that the sending switch 6 (B.2) is locked by the solenoid 14 (B.2) and that the circuit of said solenoid 14 (B.2) is controlled by the current passing from station 3, through the terminal 31 (B.3), the receiving switch 7 (B.3), over the line-wire 5 (B). As soon then as the operator of station 3 decides to allow the said train on the block B he pulls his switch 7 (B.3), which is not locked electrically or mechanically, and this act causes the tumbler 25 (B.3) to lock the sending switch 6 (B.3) and also breaks the controlling circuit in the line wire 5 (B), therefore permitting the operator of station 2 to pull his sending switch 6 (B.2) and make ready for the train to pass through his station from block A on to block B. The act of pulling the sending switch 6 (B.2) causes the tumbler 21 (B.2) thereof to lock the receiving switch 7 (B.2) and also completes the circuit in the line wire 5 (B) and causes the circuit containing the solenoid 12 (B.3) to the lock receiving switch 7 (B.3) in its receiving position; it also causes the circuit containing the solenoid 15 (B.2) to lock the sending switch 6 (B.2) in its sending position. This act also causes the index cards 51 (B.2) and 55 (B.3) to swing before their respective windows 47 (B.2 and B.3) indicating that the block B is set for a train to pass from station 2 to station 3 thereover. The train is therefore free to enter the block B from the block A and it is impossible for the operators of block B, stations 2 or 3, to alter the signals so as to allow a train to enter the same block B from the opposite direction, that is from station 3. The train then passes over block B, from station 2 to 3 and on arriving at station 3 it breaks the circuit of the solenoid 12 (B.3) at the train-break 64 (B.3) thus unlocking the receiving switch 7 (B.3). The signals however remain unchanged until the operator of station 3 pushes the receiving switch 7 (B.3)

into the line-clear position. This act neutralizes the line wire 5 (B) and releases the solenoid 15 (B.2) so as to unlock the sending switch 6 (B.2) and allow the operator of station 2 to throw the said switch into line-clear position, and by so doing the circuit through the line-wire 5 (B) is again completed and the solenoid 14 (B.2) energized to lock the said switch 6 (B.2) in this line-clear position.

Having described my invention what I claim is:—

1. In a system for train control; the combination of an electric circuit comprising a generator in one station, one terminal of said generator being grounded, a line wire to the other station, and a ground to the line wire in the other station; a sending switch interposed in said circuit in one station; a receiving switch interposed in said circuit in the other station; and electrically operated locking means, controlled by the current in the said circuit and adapted to lock said sending switch on said circuit, whereby said sending switch is prevented from movement unless said receiving switch breaks said circuit.

2. In a system for train control; the combination of an electric circuit comprising a generator in one station, one terminal of said generator being grounded, a line wire to the other station, and a ground to the line wire in the other station; a sending switch interposed in said circuit in one station; a receiving switch interposed in said circuit in the other station; an indicator in each station controlled by the current in said circuit; and electrically operated locking means, controlled by the current in said circuit and adapted to lock said sending switch, whereby said sending switch is prevented from movement unless said receiving switch breaks said circuit.

3. In a system for train control, the combination of two alternate circuits in each adjacent station, one of said circuits in each station being grounded, the other circuit in each station including a generator; a line wire between the stations; a sending switch in one station adapted to connect the line wire to either circuit in the said station; a receiving switch in the other station adapted to connect the line wire to either circuit in the said other station, whereby a main circuit is completed when one of said switches is connected to the generator circuit in its station and the other switch is connected to the grounded circuit in its station and is not completed under any other circumstances; an electrically operated locking means controlled by each circuit controlled by said sending switch to lock it in connection therewith when said main circuit is completed; and an electrically operated locking means controlled by one only of the circuits controlled by said receiving switch to lock it in connection therewith when said main circuit is completed.

4. In a system for train control, the combination of two alternate circuits in each adjacent station, one of said circuits in each station being grounded, the other circuit in each station including a generator; a line wire between the stations; a sending switch in one station adapted to connect the line wire to either circuit in the said station; a receiving switch in the other station adapted to connect the line wire to either circuit in the said other station, whereby a main circuit is completed when one of said switches is connected to the generator circuit in its station and the other switch is connected to the grounded circuit in its station and is not completed under any other circumstances; an electrically operated locking means controlled by each circuit controlled by said sending switch to lock it in connection therewith when said main circuit is completed; and an electrically operated locking means controlled by one only of the circuits controlled by said receiving switch to lock it in connection therewith when said main circuit is completed; and train-operated means for releasing said last locking means.

5. In a system for train control, the combination of a generator; two alternate circuits in a station; a switch adapted to connect either one of said circuits to a line wire; an electro-magnet in each of said circuits, a common armature for both said electro-magnets; and an index attached to said armature to indicate the circuit to which the switch has connected the line wire.

6. In a system for train control, the combination of a generator; two alternate circuits in a station; a switch adapted to connect either one of said circuits to a line wire; an electro-magnet in each of said circuits; a common armature for both of said electro-magnets; a fixed index card; and a movable index card attached to said armature and adapted to pass in front of said fixed card when one of said electro-magnets is energized and to be wholly withdrawn from said index card when the other electro-magnet is energized.

7. In a system for train control, the combination of two alternate circuits in each adjacent station, one of said circuits in each station being grounded, the other circuit in each station including a generator; a line wire between the stations; a sending switch in one station adapted to connect the line wire to either circuit in the said station; a receiving switch in the other station adapted to connect the line wire to either circuit in the said other station; whereby a main circuit is completed when one of said switches is connected to the generator circuit in its station and the other switch is connected to

the grounded circuit in its station and is not completed under any other circumstances; an electro-magnet in each of said four alternate circuits, said electro-magnets being arranged in pairs, one pair in each station; a common armature for both electro-magnets in a pair; a fixed index card adjacent each pair of electro-magnets; and a movable index card attached to each armature and both adapted to pass in front of said fixed cards when one switch is connected to the generator circuit so that the current will flow in one direction in the main circuit, and both adapted to be wholly withdrawn from said fixed index cards when the other switch is connected to the generator circuit so that the current will flow in the other direction in the main circuit.

8. In a system for train control, the combination of two pairs of alternate circuits in each adjacent station, one circuit of each pair in each station being grounded, the other circuits in each station including a generator; a sending switch in each station adapted to connect to either circuit of one pair; a receiving switch in each station adapted to connect to either circuit of the other pair, two separate line wires extending from station to station, each wire joining the sending switch of one station to the receiving switch of the other station and each completing a main circuit when a generator circuit of one station is connected therethrough to a grounded circuit of the other station; an electrically operated locking means for each sending switch, controlled by each circuit controlled by said switches, to lock them in connection with either of their circuits when its main circuit is completed; an electrically operated locking means for the receiving switch in one station controlled by one of its alternate circuits to lock it in connection therewith when its main circuit is completed; and locking means for the receiving switch of the other station to lock it in connection with the other alternate circuit when the first receiving switch is electrically locked and when the main circuit of the first receiving switch is completed.

9. In a system for train control, the combination of two pairs of alternate circuits in each adjacent station, one circuit of each pair in each station being grounded, the other circuit in each station including a generator; a sending switch in each station adapted to connect to either circuit of one pair; a receiving switch in each station adapted to connect to either circuit of the other pair; two separate line wires extending from station to station, each wire joining the sending switch of one station to the receiving switch of the other station and each completing a main circuit when a generator circuit of one station is connected therethrough to a grounded circuit of the other station; an electrically operated locking means for each sending switch, controlled by each circuit controlled by said switches, to lock them in connection with either of their circuits when its main circuit is completed; an electrically operated locking means for the receiving switch in one station controlled by one of its alternate circuits to lock it in connection therewith when its main circuit is completed; train-operated means for releasing said last locking means; and locking means for the receiving switch of the other station to lock it in connection with the other alternate circuit when the first receiving switch is electrically locked and when the main circuit of the first receiving switch is completed.

10. In a system for train control, the combination of two pairs of alternate circuits in each adjacent station, one circuit of each pair being grounded, the other circuits in each station including a generator; a sending switch in each station adapted to connect to either circuit of one pair; a receiving switch in each station adapted to connect to either circuit of the other pair; two separate line wires extending from station to station, each wire joining the sending switch of one station to the receiving switch of the other station and each completing a main circuit when a generator circuit of one station is connected therethrough to a grounded circuit in the other station; an electro-magnet in each of said eight alternate circuits, said electro-magnets being arranged in pairs, one pair for each switch in each station; a common armature for both electro-magnets in a pair; a fixed index card between the pairs of electro-magnets in each station; a movable index card attached to each armature and adapted to pass in front of said fixed card when the switch controlling the pair of solenoids is thrown to energize the lower solenoid of the pair, and to be wholly withdrawn from said fixed card when the said switch is thrown to energize the upper solenoid of the pair; and means for interlocking the two switches so that only one of said movable index cards can be in front of said fixed index card at a time.

In testimony whereof I affix my signature in presence of two witnesses.

ROBERT W. TAYNTON.

Witnesses:
M. F. McNeil,
J. S. Ellsworth.