No. 887,289. PATENTED MAY 12, 1908.

J. D. TAYLOR.

APPARATUS FOR CONTROLLING THE PASSAGE OF TRAINS.

APPLICATION FILED OCT. 26, 1904.

4 SHEETS—SHEET 1.

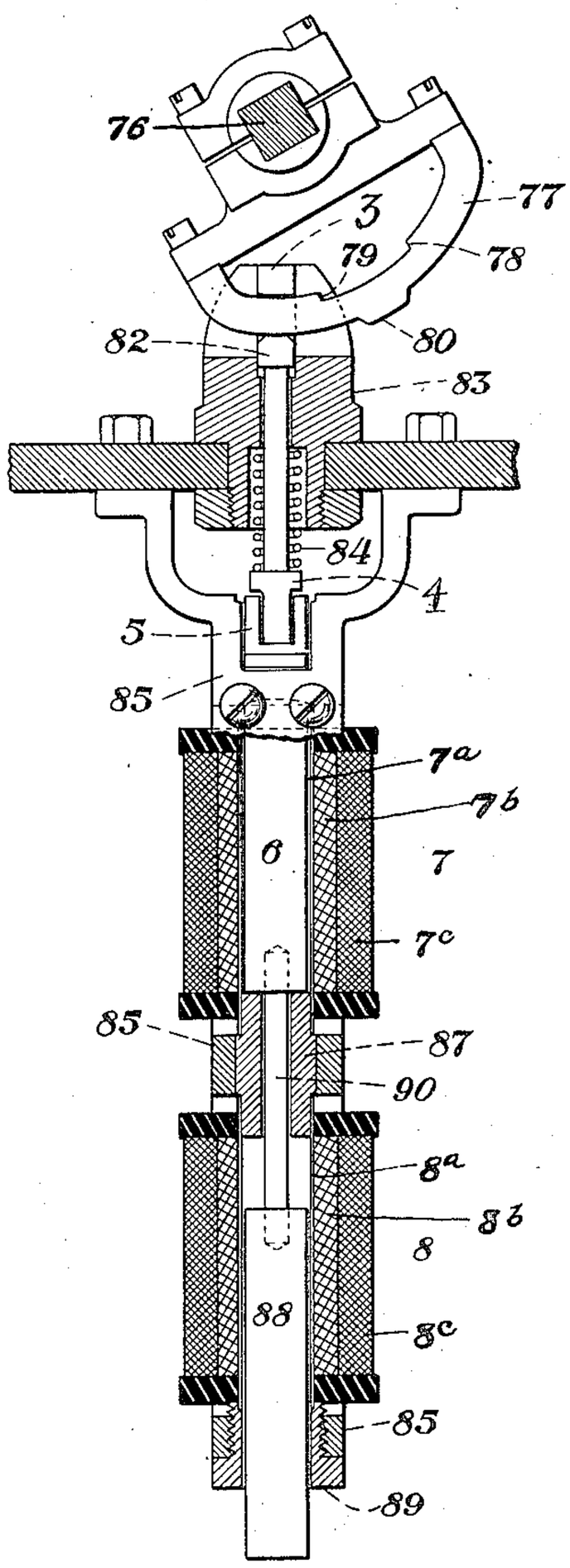

Fig. 1.

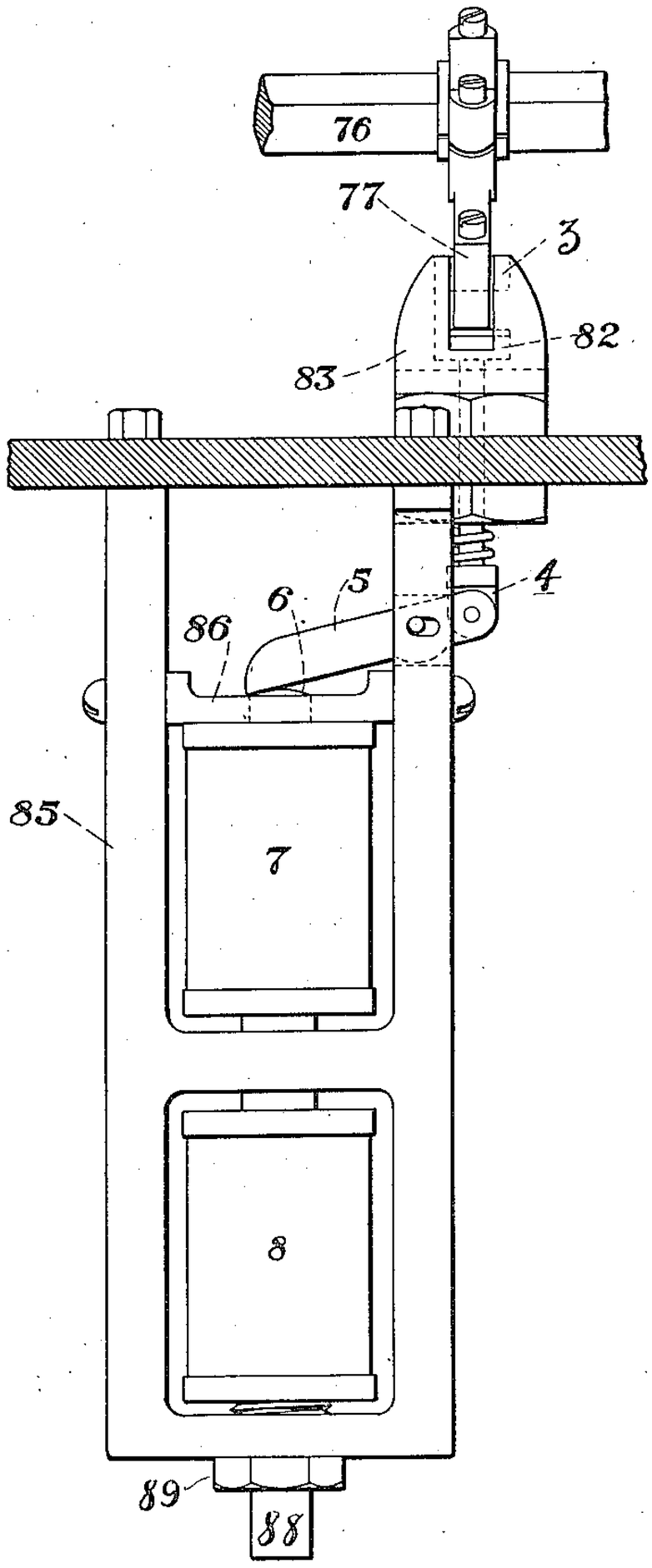

Fig. 2

WITNESSES:

W. A. Cadwallader

I. H. Peterson

INVENTOR.

John D. Taylor

BY Fred E. Brown

his ATTORNEY.

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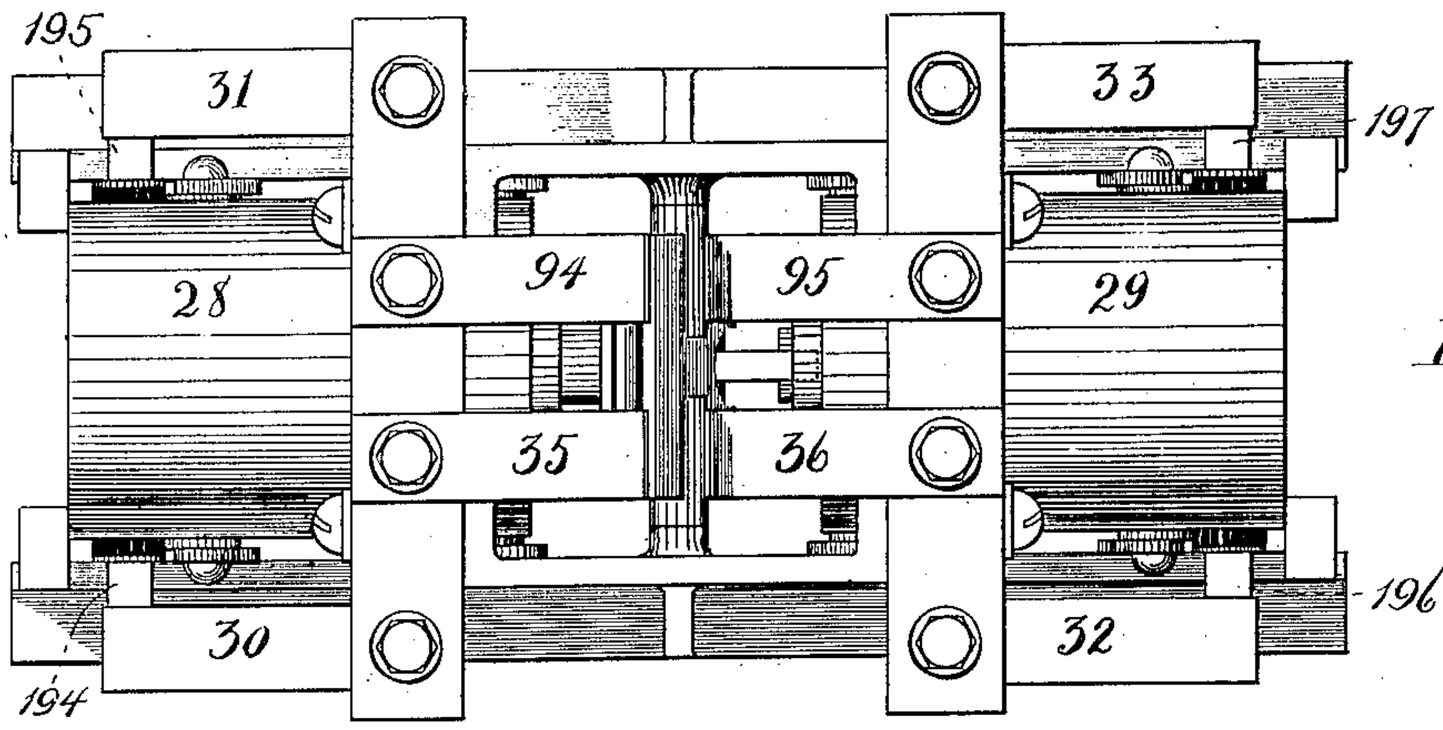

Fig 3.

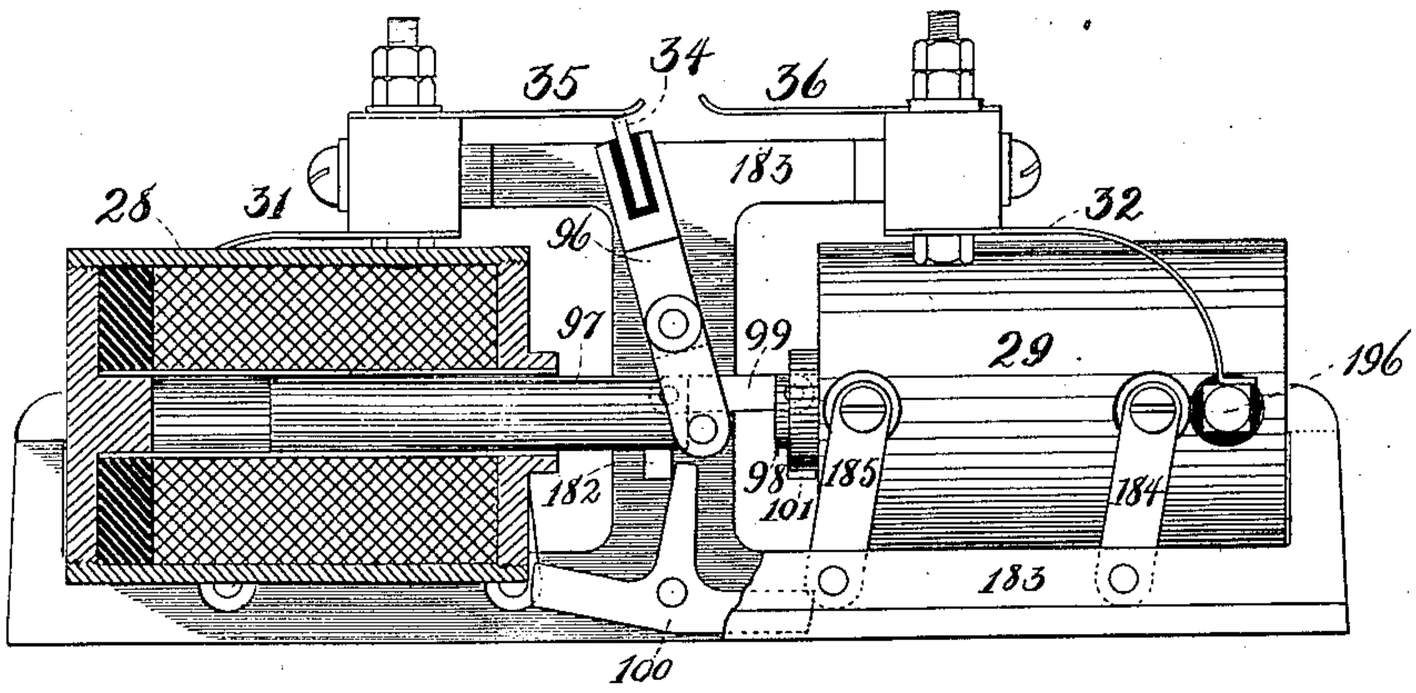

Fig 4.

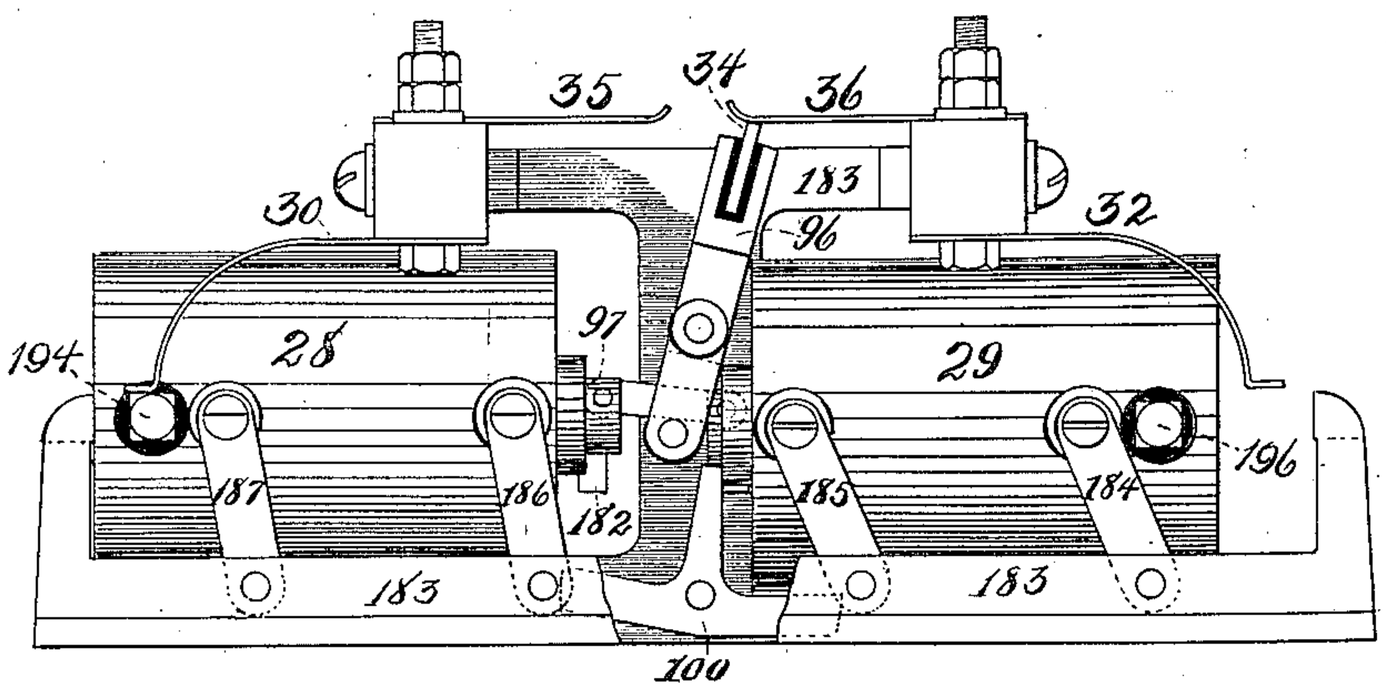

Fig. 5.

WITNESSES:

W. H. Caldwallader

I. H. Patenall.

INVENTOR.

John D. Taylor

BY Geo. E. Crosby

his ATTORNEY.

No. 887,289. PATENTED MAY 12, 1908.

J. D. TAYLOR.

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4 SHEETS—SHEET 3.

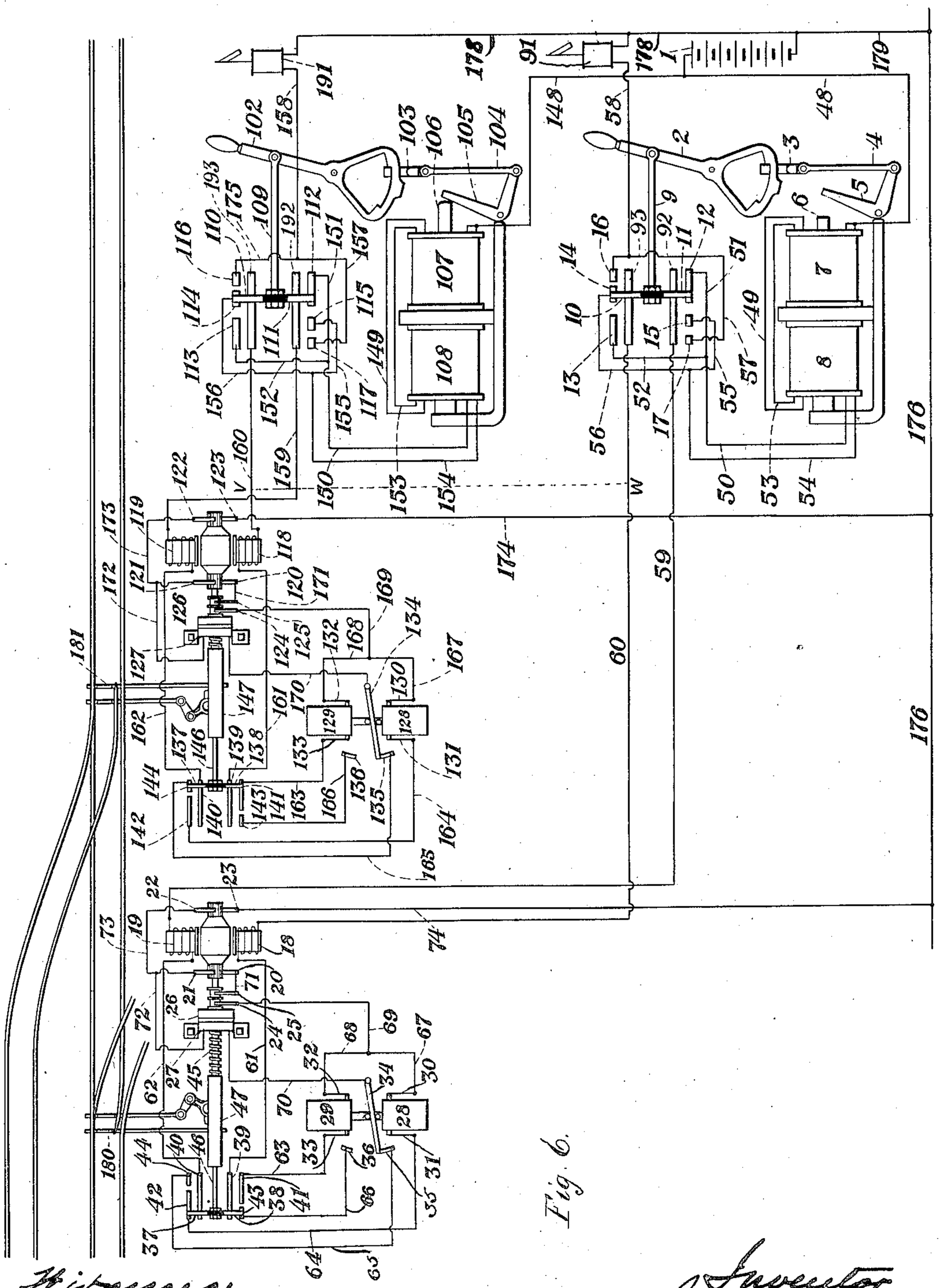

Fig. 6.

Witnesses:-
W. H. Cadwallader.
I. H. Pattendall.

Inventor
John D. Taylor
By Fred E. Crane.
His Atty.

No. 887,289. PATENTED MAY 12, 1908.

J. D. TAYLOR.

APPARATUS FOR CONTROLLING THE PASSAGE OF TRAINS.

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4 SHEETS—SHEET 4.

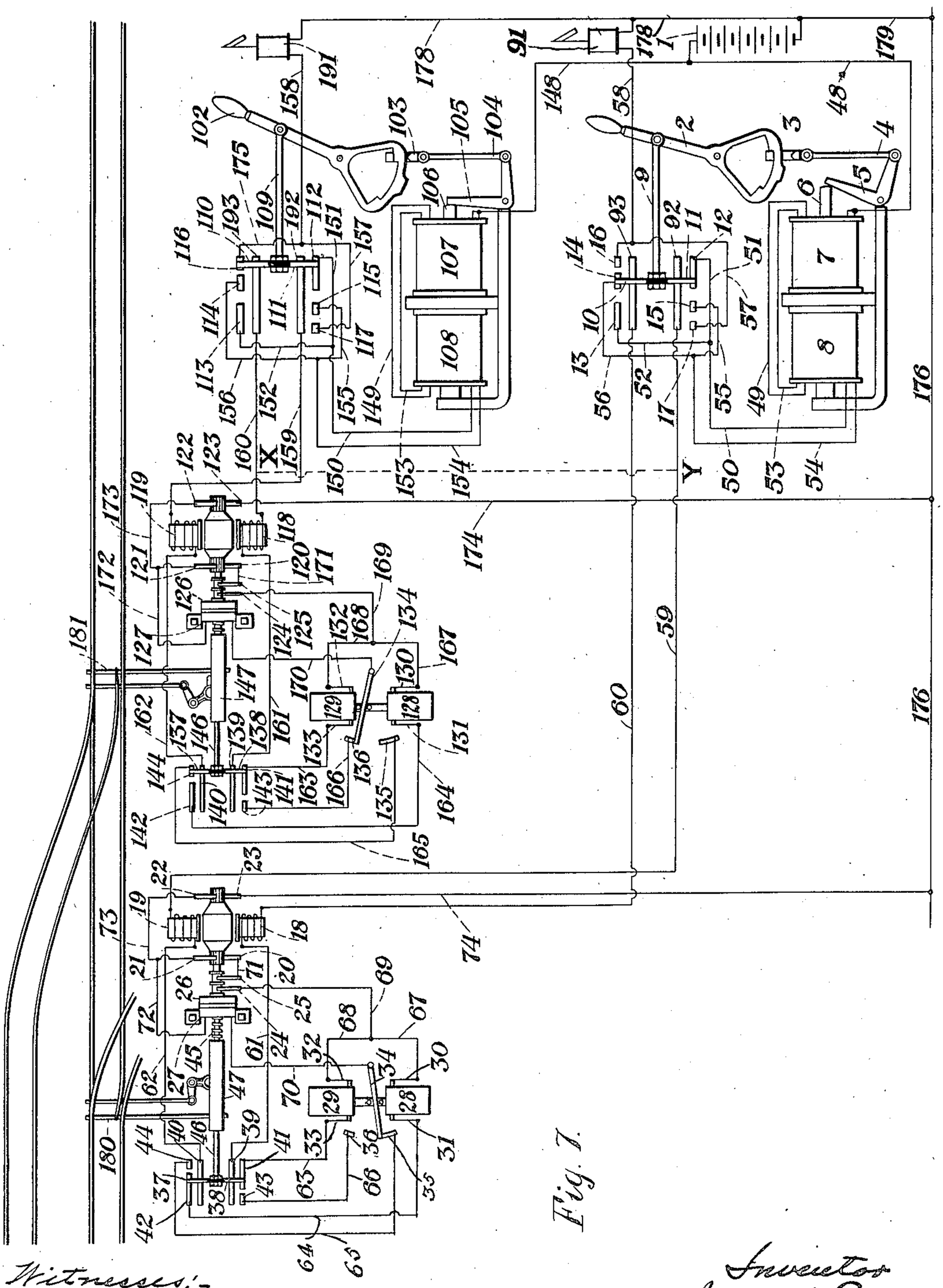

Fig. 7.

Witnesses:-
W. H. Cadwallader
I. H. Patenall.

Inventor
John D. Taylor
By Fred C. Evans.
His atty.

UNITED STATES PATENT OFFICE.

JOHN D. TAYLOR, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO THE UNION SWITCH AND SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

APPARATUS FOR CONTROLLING THE PASSAGE OF TRAINS.

No. 887,289. Specification of Letters Patent. Patented May 12, 1908.

Application filed October 26, 1904. Serial No. 230,039.

To all whom it may concern:

Be it known that I, JOHN D. TAYLOR, of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Apparatus for Controlling the Passage of Trains, of which the following is a specification.

My invention relates to that class of apparatus comprising a part or appliance for controlling the passage of trains along a railway. The particular class of apparatus to which the invention relates is railway switching apparatus in which electricity is the motive force.

Two objects of my invention are one, to afford additional safeguards against false indications occurring on account of the indication wire of one switch operating motor being crossed with that of another switch operating motor, and two, to provide means for preventing improper movements of switch rails by their operating motors which would result from crossed wires including such motors, while permitting the operating wire to remain in connection with the battery in the cabin or tower.

I will describe a railway switching apparatus embodying my invention and then point out the novel features thereof in claims.

This invention may conveniently be used in connection with the method of operation and control described in my application filed April 18th, 1904, Serial No. 203,645.

In the accompanying drawings, Figure 1 is a vertical sectional view of an indication mechanism or apparatus for a controlling lever embodying my invention. Fig. 2 is an elevation thereof, and in a plane at right angles to the plane of section of Fig. 1. Figs. 3, 4 and 5 are views of a safety apparatus or mechanism employed in connection with the operating wires embodying my invention. Figs. 6 and 7 are diagrammatical views of circuits and apparatus which may be employed in carrying out my invention.

Similar letters of reference designate corresponding parts in all of the figures.

Referring now to Figs. 1 and 2, which illustrate a mechanism or apparatus by means of which I may attain the first mentioned object, 76 designates one of a number of lever shafts of an interlocking machine which is capable of a rotational or oscillatory movement upon a movement of a controlling lever. (Not shown.) These interlocking machines are well known in the art and will not be further described. Each lever and shaft is locked against final movement in either direction by means of a mechanical lock which, as shown, comprises a notched segment 77 attached to the shaft 76 and having shoulders 78 and 79 and a latch 3, which engages with the shoulders. The latch 3 is free only to slide vertically in a fixed guide 83. The latch 3 is forced by mechanical means, which may comprise a projection 80 on the segment 77 and a part 82 formed on the latch 3, into a position to engage with either of the shoulders 78 and 79. The purpose of locking the levers against final movement in either direction is also well known in the art and will not be described.

The mechanism for releasing the lever when the position of the switch rail has been indicated, as here shown comprises electromagnets 7 and 8 preferably of the solenoid type. Their cores 6 and 88 and an armature 5 for the magnet 7 are connected to the latch 3 by means of a rod 4. The coils of the magnets 7 and 8 are wound on brass or other non-magnetic tubes 7^a and 8^a, which are supported in a frame 85. The frame 85 should be of magnetic material, cast steel preferably. The part 86 and the rod 90 which latter joins or connects the two cores 6 and 88 should be of non-magnetic material such as brass. The cores 6 and 88 slide freely in the brass tubes 7^a and 8^a.

The windings of the two magnets 7 and 8 are the same, each comprising an inner coil 7^b, 8^b having few turns of large wire and an outer coil 7^c, 8^c having a large number of turns of small wire. The two inner coils are joined in series with each other, and the two outer coils are likewise joined in series one to the other. The switch motor operating current flows through the two inner coils during the movement of the switch rails and the generation of the indication current. The outer coils are energized by a current from the battery during the movement of the switch rails and by current from the generator end of the switch operating motor during indication, the latter or indicating current being opposite in direction to the former or operating current. The windings and connections of the coils are such that the magnetizing effects of the current in the outer and inner coils of one magnet are added to-

gether while at the same time the magnetizing effects of the current in the outer and inner coils of the other magnet are in opposition. To be more explicit, while the switch is being operated in response to a movement of its lever two circuits are closed. The operating current flows through one circuit including the two inner coils and a current from the battery flows through the other or second circuit which includes the two outer coils. These two currents flow in such direction that their effects are united in the magnet 8 and in opposition in the magnet 7. The resistances in the two circuits and the number of turns in the inner and outer coils are so proportioned that the effects of the two coils in magnet 7 nearly, if not quite, balance and neutralize each other. While the indication current is being generated the motor operating current flows through the inner coils in the same direction as it does while the switch is being operated but the indication current flows through the outer coils in a direction opposite to that of the battery current previously flowing through them so that the effect is to energize the magnet 7 and neutralize the magnet 8. This is all clearly set forth in my application above referred to.

The movement of the lever to a position to establish the circuits above mentioned puts the segment 77 into a position to permit the latch 3 to rest in the notch between the shoulders 78 and 79, in fact the movement of the lever to the said position forces the latch 3 into the notch by means of the projection 80 where it is held by the spring 84. The latch 3 dropping into the notch in 77 forces the end of the armature 5 upwardly and away from the core 6. When the currents first above named flow through the coils of the magnets, neutralizing magnet 7 and energizing magnet 8, the core 88 will be lifted and through the brass rod 90 connecting it with the core 6 the latter will be pushed up into contact with the armature 5. If in this position the current in the outer coils should die out, the cores will be held in the position above named by the current in the inner coils because there is a complete iron magnetic circuit around the coils of magnet 8 while the magnetic circuit around the coils of the magnet 7 is broken by a large air gap which is between the end of the core 6 and frame 85. When the current in the outer coils changes direction and becomes strong enough to neutralize magnet 8, magnet 7 will be strongly energized and will draw down its core 6 and with it the armature 5, the latter due to the magnetic attraction between the core 6 and armature 5, the magnetic circuit around the coils of magnet 7 being through core 6, armature 5 and frame 85. The attraction between the armature 5 and the core 6 will be greater than the pull of the coils on 6 on account of the greater intensity of the flux from the armature 5 to the core 6 due to the reduced area of contact between them. The upper end of the core 6 is rounded for the double purpose of accommodating itself to the motion of the armature 5, and for reducing the area of contact between them. The armature 5 is pivoted to the frame 85 so that drawing down the end in contact with the core 6 will elevate the end connected to the latch 3 by the rod 4 and will thus lift the latch 3 out of the notch in 77 and permit the lever to make its final movement. It will thus be seen that the process of indication requires two movements; the first placing the apparatus in a position to indicate by means of battery currents through both operating wires in circuit with which the two series of coils are placed respectively; the second requiring a movement in the opposite direction produced by battery current in the inner coils and the indication current from the motor generator in the outer coils. The purpose of this will be further explained in connection with the diagrams Figs. 6 and 7.

A preferred form of apparatus for preventing false movements of switch rails from crossed wires is shown in Figs. 3, 4 and 5. This piece of apparatus also performs the function of opening the operating circuit after the indication has been received, and the lever has made its final movement. It comprises magnets 28 and 29, preferably of the solenoid type, supported on pivoted arms which permit of longitudinal movements of the magnets. Brushes 30 and 31 are for leading current into and out of the energizing coil of magnet 28 through terminals 194 and 195 which are connected to the ends of the coil. Brushes 32 and 33 are for leading current into and out of the magnet 29 by way of terminals 196 and 197. The brushes 30, 31, 32 and 33 and their terminals constitute circuit controllers and they are included in the operating circuits of the motor as will hereinafter appear. A circuit controller operated by the magnets 28 and 29 preferably comprises brushes 35, 94, 36, 95 and a movable contact piece 34 which may make contact with the pair of brushes 35 and 94 or with the pair 36 and 95. The contact piece 34 is carried by an arm 96 pivoted to a frame 183 and adapted to engage at its lower end the cores 97 or 98 for the purpose of shifting the contact 34 from one of the said pairs of brushes to the other. The contact 34 together with the two pairs of brushes with which it may contact, forms a circuit controller for breaking the driving circuit of the dynamotor at the end of a movement of a switch rail or rails, and after the indication mechanism has been operated and the lever moved to its final position. If, with the apparatus as shown in Figs. 3 and 4, the magnet 28 is energized, the core 97 will be drawn into it and the core 98

which is connected to 97 by a link 99 will be withdrawn from the magnet 29. After the cores have moved a short distance the end of the core 98 will strike the lower end of an arm 96, and the core during the remainder of its stroke will move the contact 34 from the pair of brushes 35, 94, to the pair of brushes 36, 95. During this movement the magnet 28 has been locked against movement by the latch 100. Near the end of the movement of the core 98, the latch 100 will be shifted by the pin 101 carried by the core 98 so as to lock the magnet 29 preparatory to the return movement. If the magnet 29 was also energized the core 98 could not be withdrawn therefrom so that the magnet 29 itself would have to move in response to the pull of the core 97 and it would take the position shown in Fig. 5. In this position the brushes 32 and 33 would no longer make contact with the terminals 196 and 197. Current would therefore stop flowing in the coil of magnet 29 and in everything else that was in series with it.

With this preliminary description of the apparatus peculiar to this invention, I can now refer to Figs. 6 and 7 the more fully to set forth the invention. Figs. 6 and 7 are diagrammatic views of an arrangement of circuits and parts controlling them and operated thereby.

For further details of apparatus not herein specifically described reference may be had to the application hereinbefore referred to.

Each switch operating motor is provided with two independent armature windings, each having a commutator and a pair of brushes. Both of these coils are used in series for driving the motor during the movement of the switch rails. After the switch rails have been moved and locked, the circuit is changed so that the operating current flows through only one of the said windings while the other is used for generating the indication current. In other words, a motor and motor generator are employed and combined in one machine which I have termed a dynamotor. The motor is also provided with two field coils for the purpose of reversing the direction of rotation of the armature. One of these coils only is used when the switch is to be moved in one direction, while the other is used when the switch is to be moved in the opposite direction. This is all clearly set forth in the application above referred to.

To each armature shaft of a motor for operating the apparatus connected with a switch rail or rails, for example switch rails 180, is one part 26 of a two part magnetic clutch. The second part 27 of the clutch is fixed to the frame of the switch and lock movement. Between the parts 26 and 27 is an armature capable of being engaged with or by either part of the clutch. The same armature is keyed to the screw 45 or other operating or equivalent part of the switch and lock movement in such manner as to have lateral movement enough to permit its engagement by either part 26 or 27. As the part 26 rotates, the terminals of the energizing coil thereof are connected with rings on which collector brushes 24 and 25 bear. The energizing coil of the part 27 is included in a circuit to be hereinafter described.

In Fig. 6 the levers 2 and 102 are shown in the position they would have when moved toward the "normal" position until stopped by the latches 3 and 103. The switch 180 is just commencing the movement towards "normal" position and the switch 181 has just completed the "normal" movement and is ready to indicate. The operating circuit for the "normal" movement of switch 180 is as follows: Starting from one pole of the battery 1 from which current will flow through wire 48, inner coil of magnet 7, wire 49, inner coil of magnet 8, wires 50, 51, contacts 12, 11, 92, wire 59, field coil 19, wire 62, contacts 40, 37, 42, wire 64, brush 31, magnet 28, brush 30, wires 67, 69, brush 24, clutch 26, brush 25, wire 71, brush 20, first series motor armature coils, brush 21, wire 73, brush 22, second series motor armature coils, brush 23, wires 74, 176, 179 back to battery 1. This current causes the motor armature to rotate and the clutch 26 to engage its armature and thereby transmit motion to the switch and lock movement through the screw 45. The operating current flowing through the magnet 28 has no effect other than to tend to hold the contact arm 34 in contact with 35 as shown, where it has been put by the previous movement.

When the bar 47 has been moved far enough to put the contact 38 into connection with the contact 41 (see Fig. 7), another circuit is established so that current flows from the battery 1 through wire 48, outer coils of magnet 7, wire 53, outer coils of magnet 8, wires 54, 56, contacts 14, 10, 93, wire 60, field coil 18, wire 61, contacts 39, 38, 41, wire 63, brush 33, magnet 29, brush 32, wires 68, 69, where it joins the operating current, thence through the clutch 26 before described, and motor armature, and the wires 74, 176, 179 back to battery 1. This last named current flowing in the outer coils of 7 and 8 in conjunction with the operating current flowing in the inner coils of said magnet acts to energize the magnet 8 and neutralize the magnet 7, so that the core 6 is pushed out against the armature 5. The current last named flows through the magnet 29, but is too light to have any effect on the apparatus of which the magnet 29 is part because of the resistance of the outer coils of magnets 7 and 8.

As the circuits of all switches are alike, I will describe the circuits for developing the

indication current in connection with switch 181, Fig. 6, which is shown in position ready to indicate. For convenience I have advanced each reference character 100. Current for driving the motor after the switch rails have been moved and locked and to have it act as a motor generator flows from battery 1, wire 148, inner coils of magnets 107, 108, wires 150, 151, contacts 112, 111, 192, wire 159, field coil 119, wire 162, contacts 140, 137, 144, wire 165, contact 135, contact arm 134, wire 170, clutch 127, wires 172, 173, brush 122, second series motor armature coils, brush 123, wires 174, 176, 179 back to battery 1. This current energizes the fixed clutch 127 and stops the rotation of the clutch armature, and the gearing to which it is attached. It also in passing through the field coil 119 and the second series of armature coils, causes the motor armature to rotate, and the first series of motor armature coils to develop a current which flows from brush 120, through wire 171, brush 125, clutch 126, brush 124, wires 169, 168, brush 132, magnet 129, brush 133, wire 163, contacts 141, 138, 139, wire 161, field coil 118, wire 160, contacts 193, 110, 114, wires 156, 154, outer coils of magnets 108 and 107, inner coils of magnets 107, 108, wires 150, 151, contacts 112, 111, 192, wire 159, field coil 119, wire 162, contacts 140, 137, 144, wire 165, contacts 135, 134, wire 170, clutch 127, wire 172, back to brush 121. This current flows in the outer coils of magnets 107, 108, in a direction to co-act with the operating current in the inner coils of said magnets so as to neutralize magnet 108 and energize the magnet 107 which results in drawing the core 106 into the magnet 107, and moving the lever 105 and the latch 103 into the position shown in Fig. 7. This permits the lever 102 to make its final movement and take the position shown in Fig. 7. The indication current flows through the magnet 129 and clutch 126 but is too light to affect either.

The final movement of the lever 102 establishes another circuit, the contact arm 134 remaining momentarily in the position shown in Fig. 6, so that current flows from battery 1 through wire 148, inner coils of magnets 107, 108, wires 150, 151, contacts 112, 111, 192, wire 159, field coil 119, wire 162, contacts 140, 137, 144, wire 165, contacts 135, 134, wire 170, clutch 127, wire 172, brush 121, first series motor armature coils, brush 120, wire 171, brush 125, clutch 126, brush 124, wires 169, 168, brush 132, magnet 129, brush 133, wire 163, contacts 141, 138, 139, wire 161, field coil 118, wire 160, contacts 193, 110, 116, wires 175, 158, indicator 191, wire 178 back to battery 1. This current through the magnet 129 is strong enough to cause it to move the contact arm 134 away from the contact 135 and break the circuit just described. The final movement of the lever establishes also a circuit in which the inductive effects of the motor armature and field coils produce a current, which flows from brush 120, through wire 171, brush 125, clutch 126, brush 124, wires 169, 168, brush 132, magnet 129, brush 133, wire 163, contacts 141, 138, 139, wire 161, field coil 118, wire 160, contacts 193, 110, 116, wires 175, 158, indicator 191, wires 178, 179, 176, 174, brush 123, second series motor armature coils, brush 122, wire 173, brush 121, first series motor armature coils, back to brush 120. This last named current is only an incident of the circuits necessary to perform the functions previously described, and is not an essential to the proper working of the system. Its effects upon the apparatus traversed by it are as follows: It stops the rotation of the motor armature both by its retarding effect on the said armature and its effect on the clutch 126. It energizes the magnet 129 after the battery current which previously energized the said magnet has been broken by the separation of the contacts 134 and 135. This is not essential, however, as the operating current for the next movement would pass through the magnet 129 and place the switch arm 134 in connection with the contact 136 preparatory to developing the succeeding indication current. This last named circuit serves one very useful purpose, it affords a circuit of low resistance in which the inductive effect of the decreasing magnetism of the motor field magnets may expend itself, thus preventing the potential rising to a degree which might otherwise be damaging to the insulation of wires and magnets.

In Fig. 7 the dotted line XY represents a cross or accidental connection between the wires 59 and 160. The switch 180 is in the act of moving from "reverse" to "normal" position and the wire 59 is the operating wire carrying current for the purpose. The switch 181 is shown in complete "normal" position, and the wire 160 is the one that will be operative in effecting the next or "reverse" movement of the said switch 181. The cross connection XY between the two said wires closes a circuit so that current flows from battery 1, through wire 48, inner coils of magnets 7 and 8, wires 50, 51, contacts 12, 11, 92, wire 59, cross connection XY, wire 160, field coil 118, wire 161, contacts 139, 138, 141, wire 163, brush 133, magnet 129, brush 132, wires 168, 169, brush 124, clutch 126, brush 125, wire 171, brush 120, first series motor armature coils, brush 121, wire 173, brush 122, second series motor armature coils, brush 123, wires 174, 176, 179, back to battery 1. This current would energize the operating motor of switch 181 and the clutch 126, and would

start to move the said switch 181 to the "reverse" position. When the bar 147 has moved far enough to put the contact 137 in connection with the contact 142, which occurs before the lock bolt has been withdrawn from the lock rod, another circuit is established so that current flows from battery 1 through wire 148, inner coils of magnets 107, 108, wires 150, 151, contacts 112, 111, 192, wire 159, field coil 119, wire 162, contacts 140, 137, 142, wire 164, brush 131, magnet 128, brush 130, wires 167, 169, where it joins the previously named current passing through the clutch 126, the switch operating motor armature, and wires 174, 176, 179 back to battery 1. This last named current energizes the magnet 128, while the magnet 129 is energized by the current coming through the cross connection XY. As the magnet 128 is locked by the latch 100, magnet 129 will be drawn into the position occupied by the magnet 29 shown in Fig. 5, thus separating the brushes 132 and 133 from the terminals of the magnet 129, and breaking the circuit through which current reached the operating motor from the cross connection XY. The circuit last named above remains unbroken and the switch 181 is thereby restored to the "normal" position. Current will continue to flow through the cross connections as long as the wire 59 remains charged from the battery 1, through XY, wire 160, contacts 193, 110, 116, wires 175, 158, indicator 191, and wire 178 back to the battery 1. The indicator thus shows the existence of a cross between the operating wire 160 and some other wire. Each indicator serves for both positions of the lever. As all the operating wires should be provided with fuses and the circuit last described through the indicator is of low resistance, the fuse in the wire 59 would be fused and thus indicate the other wire crossed. The fuse should be shunted by a resistance so that enough current will continue to flow through the cross to keep the indicator energized until it can be discovered and the trouble located. The magnet 129 will have to be replaced by hand which should not be done however until the trouble is located and removed.

In Fig. 6 the dotted line VW represents an accidental cross connection between two wires, one of which, 160, is the indicating wire of a switch just in the act of indicating, and the other, 60, the indicating wire of a switch just commencing to move. As the first series of coils of the motor of switch 181 are generating current which flows back through wire 160, and the outer coils of magnets 107, 108 it will also flow through the cross connections VW and the outer coils of magnets 7 and 8 to the common connection 48 and 148, which joins the two sets of coils. It flows in such direction through the outer coils of magnets 7 and 8 that co-acting with the current operating the switch 180 and flowing through the inner coils of magnets 7 and 8 it energizes the magnet 7 and neutralizes the magnet 8, so that it simply tends to hold the core 6 in the position shown, without any effect on the armature 5 because the air gap between the core 6 and the armature 5 is too great.

When the switch 180 moves far enough to put the contact 38 into connection with the contact 41, the wire 60 is connected through the field coil 18, wire 61, contacts 39, 38, 41, wire 63, brush 33, magnets 29, brush 32, and wire 68 to the point to which the wire 59 is connected. As the potential falls from the battery to the operating motor of switch 180 and as the resistance of the wire 60 is very small, it will be evident that the potential at the point W cannot rise high enough to cause current to flow back through the outer coils of magnets 7 and 8 towards the positive pole of the battery.

While I have described my invention in connection with an apparatus for moving switch rails, I do not wish to be so limited as to the broad invention set forth in the claims, as my invention is equally applicable to railway signals which are operated by an electric motor, and a lever for controlling the operation of the motor. The signal device of a railway signal controls the passage of trains equally as much or nearly so as does a switch rail or rails.

What I claim as my invention is:

1. In an indication mechanism for a controlling lever of an interlocking machine, the combination of a mechanical lock, a pair of magnets having movable cores for operating the lock, one of said magnets being adapted to arrange the lock ready to be released and the other of said magnets being adapted to release the lock.

2. In an indication mechanism for a controlling lever of an interlocking machine, the combination of a mechanical lock for the lever, electro-magnetic means for arranging the lock ready to be released, and electro-magnetic means for releasing the lock.

3. An indication mechanism for a controlling lever of an interlocking machine, comprising a mechanical lock for the lever, electro-magnetic means for releasing the lock, and circuits in which the electro-magnetic means are included; said electro-magnetic means being energized by current in two of said circuits for arranging the lock ready to be released and being energized by current in one of said two circuits and in a third circuit for releasing the lock.

4. In an indication mechanism for a controlling lever of an interlocking machine, comprising a mechanical lock for the lever, electro-magnetic means for releasing the lock, a source of electric current, a switch

operating motor having two armature windings, and two electric circuits; said electro-magnetic means being energized through two of said circuits by current from said source for arranging the lock ready to be released, and being energized from said source through one of said two circuits and from one of said armature windings through a third circuit for releasing the lock.

5. In an indication mechanism for a controlling lever of an interlocking machine, the combination of a mechanical lock which comprises an armature and electro-magnetic means for raising and lowering the armature and two electro-magnets each having a movable core and a connection between the two cores.

6. In an indication mechanism for a controlling lever of an interlocking machine, the combination of a mechanical lock comprising a part which is moved by electro-magnetic means, and the electro-magnetic means which comprises two magnets, a core for each magnet and a connection between the two cores, said magnets being so arranged that one when energized will move its core and thereby place the lock in position to be released, and the other when energized will move its core to release the lock.

7. An indication mechanism for a controlling lever of an interlocking machine, comprising a latch and electro-magnetic means for releasing said latch; said electro-magnetic means requiring current, first from the battery through two circuits to put it in condition to indicate, afterwards requiring current from the battery through one of said circuits and current from the switch operating motor through the other of said circuits to effect the indication.

8. An indication mechanism for a controlling lever of an interlocking machine, comprising a mechanical lock and electro-magnetic means for releasing said lock; said electro-magnetic means requiring current, first from one source to put the lock in condition to be released and afterwards requiring current from the same source and current from a different source to effect the release of the lock.

9. An indication mechanism for a controlling lever of an interlocking machine having in combination a mechanical lock, and electro-magnetic means comprising two magnets, two movable cores and an armature; said electro-magnetic means requiring current from one source to put the lock in condition to be released, and current from the same source and current from a different source to effect a release of the lock.

10. An indication mechanism for a controlling lever of an interlocking machine having in combination a mechanical lock and electro-magnetic means; said electro-magnetic means comprising an armature connected with the mechanical lock and two magnets each having two windings; said windings being so arranged that when current traverses them from one source the armature will be moved to put the lock in condition for release, and when one winding is traversed by current from the same source and the other winding is traversed by current from another and different source the armature will be moved to release the lock.

11. An indication mechanism for a controlling lever of an interlocking machine having in combination a mechanical lock and electro-magnetic means; said electro-magnetic means comprising two magnets, two movable cores and an armature, and requiring two currents in the same direction to put the lock in condition to be released, and two currents in opposite directions to effect the release of the lock.

12. The combination of an apparatus for moving switch rails comprising an electric motor, two sources of electric current, a controlling lever, circuits extending between the lever and motor and controlled by the movement of the lever, (said circuits comprising three wires), an indication mechanism comprising a lock and electro-mechanical means, said electro-mechanical means comprising two magnets each having two windings included in said circuits, said windings being so arranged that when both are traversed by current from one of said sources, the lock will be set to a position to be released, and when one winding is traversed by current from one of said sources and the other winding by current from the other of said sources the lock will be released.

13. The combination with an apparatus for moving switch rails, comprising an electric motor, said apparatus being arranged to supply current after an operation of the switch rails; a source of current for operating the motor; a controlling lever; circuits extending between the lever and motor and controlled by the movement of the lever, (said circuits comprising three wires); and an indication mechanism for the lever comprising a mechanical lock and electro-mechanical means, said electro-mechanical means comprising two magnets each having two windings included in said circuits, said windings being so arranged that when both are traversed by current from said source the lock will be set to a position to be released, and when one winding is traversed by current from said source and the other winding is traversed by current from the apparatus the lock will be released.

14. The combination with an apparatus for moving switch rails comprising a dynamotor which acts at one time solely as a motor and at another time as a motor generator, a source of current for operating the motor, a controlling lever, circuits extending

between the lever and motor and controlled by the movement of the lever, (said circuits comprising three wires), an indication mechanism for the lever comprising a mechanical lock and electro-mechanical means, said electro-mechanical means comprises two magnets each having two windings included in said circuits, said windings being so arranged that when one is traversed by current from said source and the other is traversed by current from the dynamotor the lock will be released.

15. In an apparatus for controlling the movements of vehicles on a railway the combination with a switch operating motor and operating circuits, of a circuit controller and electro-magnetic means for operating the same, said controller acting to open an operating circuit when improperly charged without disturbing any other circuit.

16. In an apparatus for controlling the movements of vehicles on a railway the combination of a switch operating motor, mechanism connecting said motor with switch rails, operating circuits, a circuit controller actuated by said mechanism, a manually operated circuit controller and an electro-magnetically actuated circuit controller, the said electro-magnetically actuated circuit controller operating to open an operating circuit when the said circuit is improperly charged by contact with another circuit without disturbing any other circuit.

17. A safety apparatus for electrically operated railway switching or signaling apparatus, comprising two electro-magnets, a circuit controller in circuit with each magnet, and means actuated by said magnets for opening either circuit controller when both magnets are energized.

18. A safety apparatus, for systems of control for railway switching or signaling apparatus which include electric motors, comprising two electro-magnets, the coils of which are in series with the motor in the operating circuits of the motor and are energized by current flowing in the operating circuits of the motor, and means operated by either electro magnet for opening an operating circuit on the motor when the other magnet is improperly energized by current flowing through a cross between its operating circuit and some extraneous source.

19. A safety apparatus for systems of control for railway switching or signaling apparatus which include electric motors, comprising two electro-magnets, the coil of one electro magnet being in series with one operating circuit of a motor through a circuit controller and the coil of the other electro-magnet being in series with the other operating circuit of the motor through a circuit controller, and means for operating the said circuit controllers when either of said electro-magnets is improperly energized by current flowing through a cross between its operating circuit and some extraneous source.

20. A safety apparatus, for systems of control for railway switching or signaling apparatus which include electric motors, comprising two electro-magnets the coils of which are in series through circuit controllers with the operating circuits of an electric motor, movable cores for said electro-magnets which are joined together, and means for permitting of a relative movement between the electro-magnets whereby either of the circuit controllers will be operated to open either of the operating circuts.

21. In an electrically operated railway switching or signaling apparatus comprising an electric motor and two operating circuits, the combination of a safety apparatus and a circuit controller; the said combination comprising two electro-magnets, one in each operating circuit, two circuit breakers, one in each operating circuit, means actuated by either magnet for operating the said circuit controller, and means actuated by both magnets conjointly for opening either of said circuit breakers.

22. In combination with an apparatus for moving switch rails comprising an electric motor, a source of current for said motor, a controlling lever, circuit controllers operated by the lever and apparatus, two operating circuits for the motor which include the said circuit controllers, an electro-magnetically operated circuit controller comprising two coils one of which is included in one operating circuit and the other in the second operating circuit, said electro-magnetically operated circuit closer being adapted to open a circuit on the motor after the switch rails have been moved and an indication given, and the indication mechanism.

23. In combination with an apparatus for moving switch rails which comprises a motor convertible into a dynamotor by a change of circuits, a source of current for the same, a controlling lever, operating and indication circuits extending between the apparatus and lever, a circuit controller operated by the lever for closing the operating circuits and the indication circuits, a circuit controller operated by the apparatus for converting the motor into a dynamotor, and an electro-magnetically operated circuit controller comprising two electro-magnets one of which is included in one operating circuit and the other in the other operating circuit of the motor, and a circuit controller operated by said magnets for opening the circuit on the dynamotor after the lever has been moved to its final position.

24. In combination with an apparatus for moving switch rails which comprises a motor convertible into a dynamotor by a change of

circuits, a source of current for the same, a controlling lever, operating and indication circuits extending between the apparatus and lever, a circuit controller operated by the lever for closing the operating circuits and the indication circuits, a circuit controller operated by the apparatus for converting the motor into a dynamotor, and an electro-magnetically operated circuit controller comprising two electro-magnets one of which is included in one operating circuit and the other in the other operating circuit of the motor, said electro-magnets being arranged in the operating circuits and controlling means to open an operating circuit of the motor when either of the operating circuits is improperly energized, and a circuit controller operated by said magnets for opening the circuit on the dynamotor after the lever has been moved to its final position.

25. In combination with an apparatus for moving switch rails comprising a motor having two armature windings, an operating circuit including the said two windings, and a source of current, a circuit including one of the said windings and the said source, electro-magnetic indication mechanism, an indication circuit including said indication mechanism and the other one of said windings acting as generator, a controlling lever, a circuit controller actuated by said lever for closing said circuits, a circuit controller actuated by the apparatus for switching the operating current from both windings to one winding, an electro-magnetically actuated circuit controller and circuit therefor completed by final movement of the lever for opening the said circuit through one winding.

26. A safety apparatus for systems of control for railway switching apparatus which include electric motors each having two operating circuits, comprising two electro-magnets included respectively in the two operating circuits of a motor, and a circuit controller actuated by said electro-magnets for opening one of said operating circuits when both magnets are energized.

27. A safety device for a railway switch operating mechanism which includes an electric motor and two operating circuits, comprising an electro-magnet in series with each operating circuit, a circuit controller actuated by said magnets for opening either operating circuit and a lock actuated by said electro-magnets for locking the controller in position to hold one of said operating circuits closed.

28. In combination with an electrically operated railway switching or signaling apparatus comprising an electric motor and two operating circuits, a safety apparatus comprising an electro-magnet and circuit controller in each of said operating circuits, means actuated by said magnets when both are energized for opening one of said operating circuits.

In testimony whereof I have signed my name to this specification in the presence of two subscribed witnesses.

JOHN D. TAYLOR.

Witnesses:
W. L. McDaniel,
J. S. Hobson.