No. 887,287. PATENTED MAY 12, 1908.

J. D. TAYLOR.

RAILWAY SWITCHING APPARATUS.

APPLICATION FILED JAN. 11, 1904. RENEWED MAR. 5, 1907.

3 SHEETS—SHEET 1.

Fig. 6

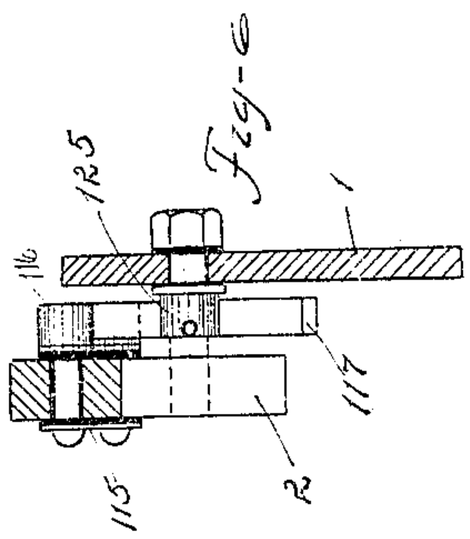

Fig. 2.

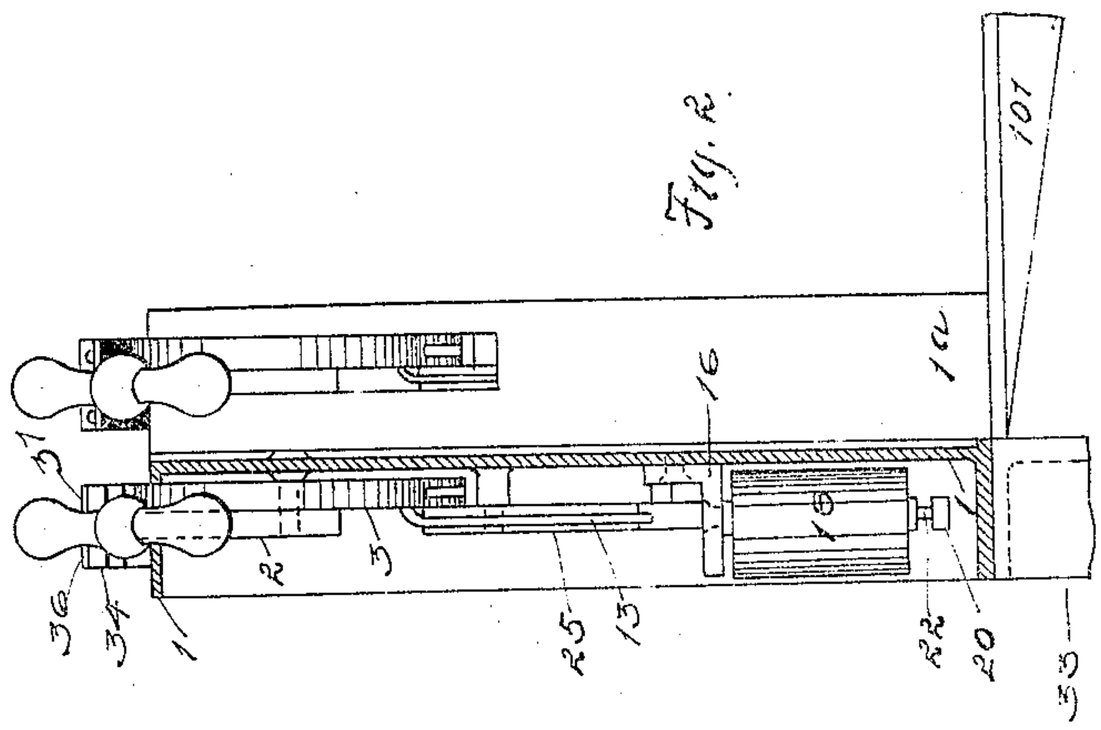

Fig. 3

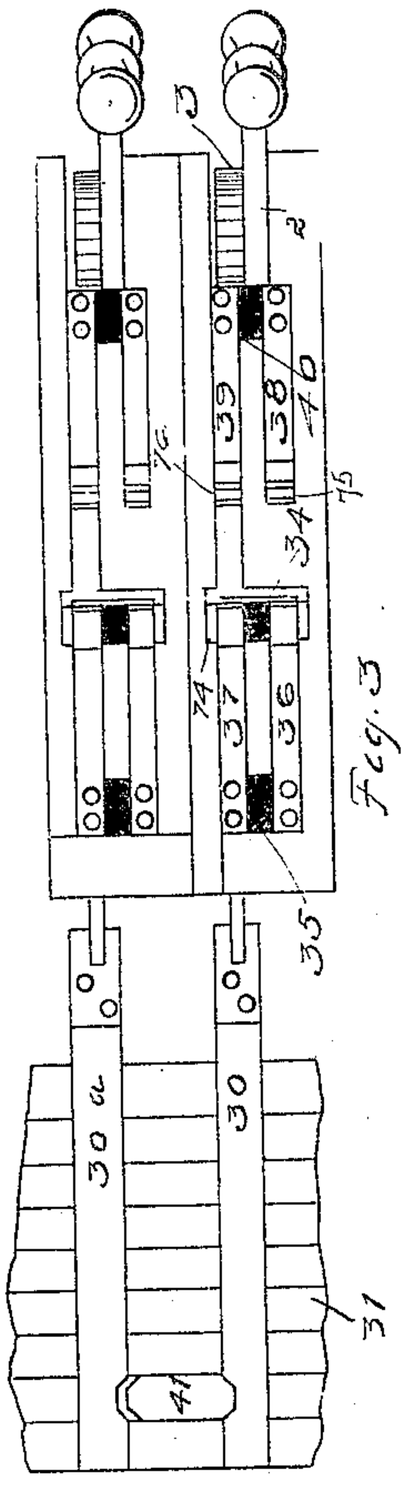

Fig. 1

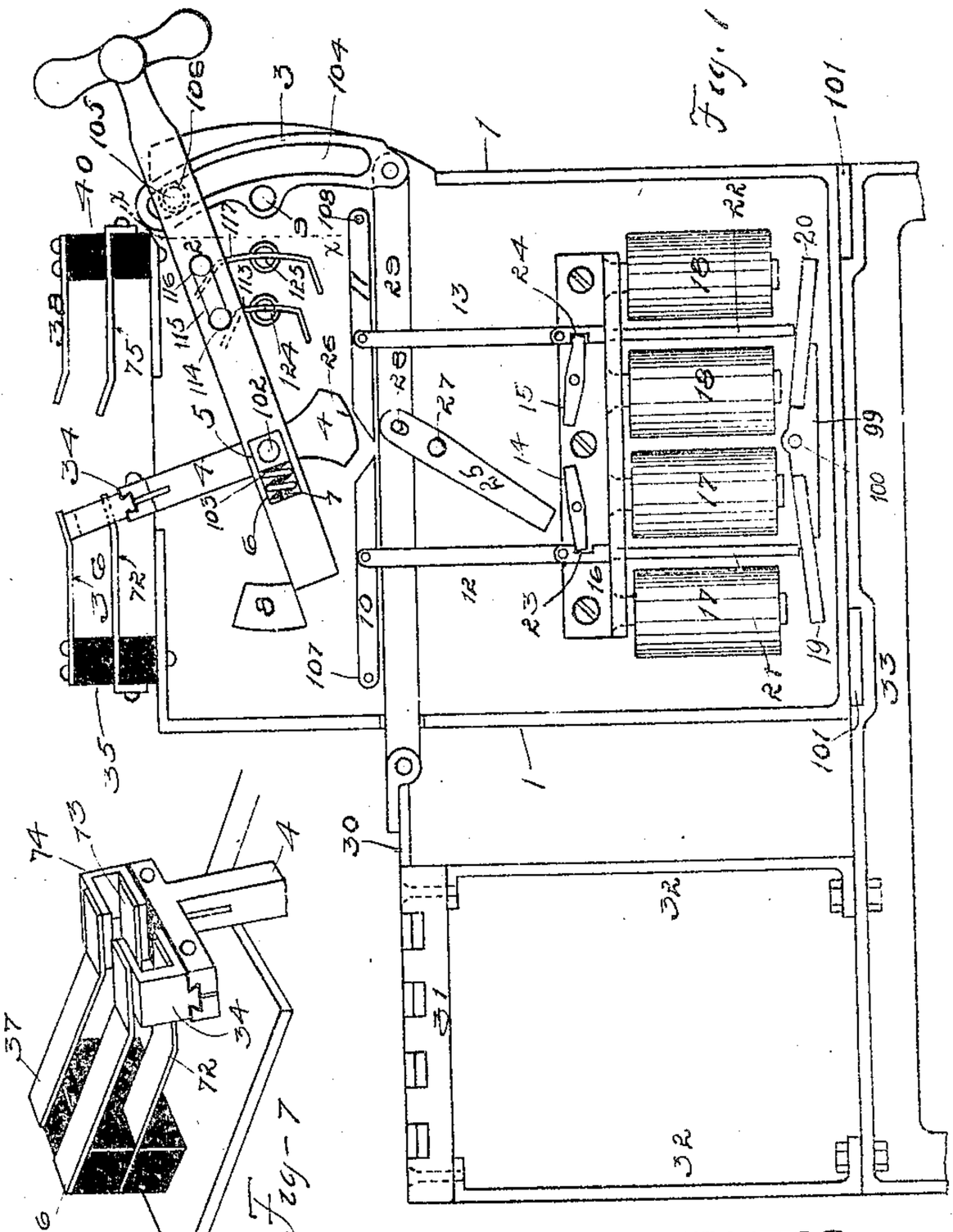

Fig. 7

WITNESSES:

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3 SHEETS—SHEET 2.

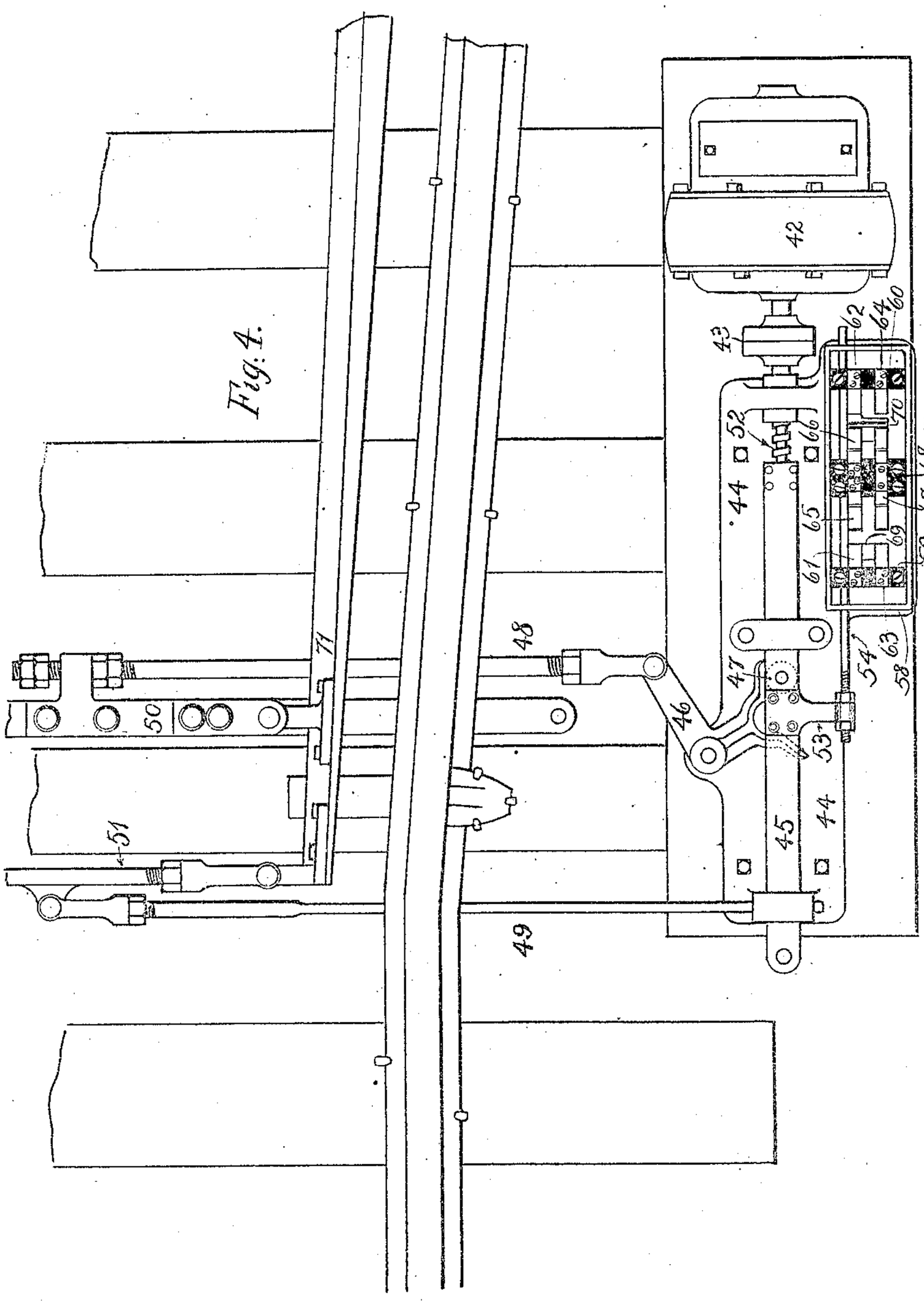

Fig. 4.

Fig. 8.

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3 SHEETS—SHEET 3.

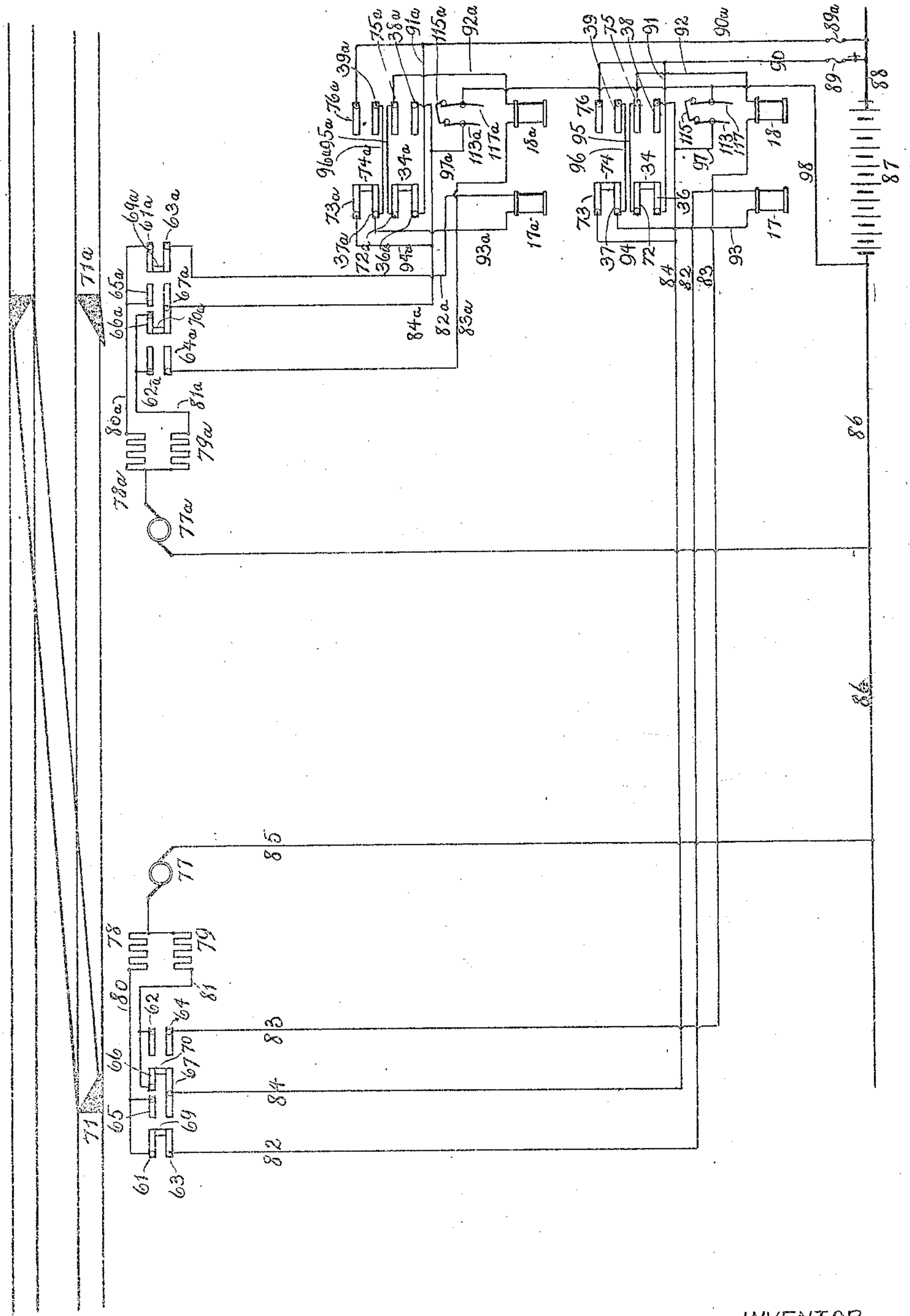

Fig. 3.

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RAILWAY SWITCHING APPARATUS.

No. 887,287. Specification of Letters Patent. Patented May 12, 1908.

Application filed January 11, 1904, Serial No. 188,424. Renewed March 5, 1907. Serial No. 360,781.

To all whom it may concern:

Be it known that I, JOHN D. TAYLOR, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented new and useful Improvements in Railway Switching Apparatus, of which the following is a full, clear, and exact description.

This invention relates to that class of railway switching apparatus in which a number of switches, as at a crossing or in a yard, are operated and controlled from a central cabin, the levers controlling the switches being interlocked with one another to prevent conflicting routes being set up, and particularly to that class in which electricity is the motive and controlling power.

The objects of my invention are the following: To provide means whereby the movements of the switches shall be always under the complete control of the operator; to secure safe and reliable indications of the positions of the switches, the said indications being the releasing of the corresponding lever to make its final movement; to arrange the circuits and apparatus to guard against false movements and false indications from crossed, grounded, or broken wires, and to simplify the apparatus required to accomplish these objects.

In describing this invention reference is to be had to the accompanying drawings illustrating a form of my invention, and in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is an end elevation of the interlocking machine, Fig. 2 is a front view of the same showing two levers assembled side by side. Any number of levers may be thus grouped. Fig. 3 is a plan of two levers of the same. Fig. 4 is a plan of the rail switch operating mechanism. Fig. 5 is a diagram of the circuits. Fig. 6 is a section on line X—X of Fig. 1, showing arrangement of brushes 113 and 117 and pins 114 and 116. Fig. 7 is a perspective of part of Fig. 1 showing the arrangement of the parts of the circuit controller operated by the levers; and Fig. 8 is a sectional elevation of the automatic circuit controller operated by the switch movement.

In Figs. 1, 2, 3, 6 and 7, 1 designates a frame for supporting the working parts of a controlling lever, a locking mechanism, an indicating mechanism and a circuit controller. This frame 1 is supported on girders 101 which are fixed to a frame 33.

2 designates a lever which has a rectangular slot 103 formed in it through which passes a square boss 5, which forms an integral part of an arm 4. The arm 4 is pivoted on a pin 102 passing through the center of the square boss 5, and the pin is fixed in the frame 1. A pin 7 set into the lever 2 and projecting into the slot 103 limits the longitudinal movement of the lever by striking the side of the square boss 5. A coil spring 6 within the slot and pressing against the end of the slot and a side of the boss 5 tends to hold the lever 2 in the position with reference to its longitudinal movement, shown, and will also throw it into that position if it has been withdrawn and released. The pin 7 also serves to retain the spring 6 in position.

The lever 2 is capable of two motions, one a longitudinal motion referred to above, and the other an angular motion around the pivot pin 102. A boss 8 formed on the frame 1 serves to hold it against angular movement when it is held in its normal longitudinal position in either of its extreme angular positions by the spring 6. The lever 2 carries a pin 105, projecting laterally through a slot 104 in a link 3. The pin 105 is provided with a friction roller 106 which fits loosely but neatly in the slot 104.

The link 3 is pivoted at 9 to the frame 1 and the slot 104 has a radius of curvature equal to the distance between the centers of the pins 102 and 105 when the lever 2 is drawn out far enough to be free from the lug 8. By means of the above named arrangement of apparatus when the lever 2 is moved in one of its longitudinal directions, an angular movement around the pin 9 is imparted to the link 3; while the lever 2 is moving through its angular range no motion at all is given to the link, and when the lever is again moved longitudinally, in its opposite angular position, by the spring 6 or otherwise, a further angular movement is given the link 3 on the pin 9.

The lower end of the link 3 is connected by means of the bar 29 to the tappet 30. The first part of the angular movement of the link 3 given to it by pulling out the lever 2 moves the tappet 30 one half way from its "normal" to its "reverse" position. The remainder of the angular movement of the

link 3, given to it when the lever 2 is moved to its lower angular limit and then pushed in longitudinally, moves the tappet to full "reversed" position. The first half of the movement of the tappet 30 locks by means of transverse locking dogs, other levers whose movement, would conflict with the new position of the lever 2, and the last half movement of the tappet 30 releases levers whose movements would not conflict with the new position of the lever 2, but would conflict with the former position. The tappets 30, 30ª, the locking plate 31, and the dog 41 are parts of the well known mechanical interlocking machine and need no further description. In plan Fig. 3, the tappet 30 "reversed" will lock the tappet 30ª at "normal".

The arm 4 carries at its upper end two contact pieces 34 and 74, insulated electrically from the arm 4 and from each other. In the "normal" position of the lever 2, the contact 34 makes electrical connection between the brushes 36 and 72, and the contact 74 electrically connects brushes 37 and 73. In the "reversed" position of the lever 2 the contact 34 connects electrically brushes 38 and 75 and the contact 74 connects electrically brushes 39 and 76. The brushes 36, 37, 72, and 73 are supported on an insulating block 35 and the brushes 38, 39, 75 and 76 are supported on a similar insulating block 40.

Two pins 114 and 116 carried by the lever 2 project laterally from the said lever and are insulated therefrom but are connected electrically to one another by a copper strip or wire 115. Two brushes 113 and 117 are supported on posts 124 and 125 respectively, said posts being supported by the frame 1 but insulated electrically therefrom. The two pins and two brushes are so located, that when the lever 2 is in either of its extreme angular positions and in its extreme inward longitudinal position, the pin 114 touches the brush 113 and the pin 116 touches the brush 117 so that electrical connection is made between the two said brushes by the said pins and the strip 115. In any other position of the lever 2, except those positions closely approximating those above named the brush 113 is insulated from the brush 117.

The bar 29 has a pin 28 projecting laterally and engaging a slot in a lever 25, the said lever 25 being pivoted at 27 to the frame 1. When the lever 2 is pulled out the angular movement thereby given to the link 3 moves the bar 29 longitudinally which in turn swings the lever 25 into a vertical position. If after this the lever 2 is "reversed" and pushed in, the final rotational movement of the link 3, given to it by pushing in the lever 2, acting through the bar 29 swings the lever 25 to the opposite side of the vertical from which it started.

14 and 15 designate latches which are pivoted at their middle points to the frame 1 and lie in substantially the same vertical plane as the lever 25. The distance between their inner ends is such as to admit the lever 25 between them when the said lever is in the vertical position. Their outer ends engage with notches 23 and 24 in the heads of armature rods 21 and 22 respectively. Normally these latches lie in such positions as to lock the lever 25 in its vertical position when once it is put in that position. The lever 25 is disengaged from the latch 14 when the armature rod 21 is pushed upwardly due to the armature 19 engaged with it at its lower end being attracted by the magnet 17 when the magnet 17 is energized. Similarly the lever 25 is disengaged from the latch 15 by the attraction between the magnet 18 and the armature 20 when the magnet 18 is energized. The armature rod 21 is connected by means of a link 12 to a lever 10 pivoted to the frame 1 at 107, and the armature rod 22 is connected by means of the link 13 to the lever 11 pivoted to the frame 1 at 108. The levers 10 and 11 lie in substantially the same vertical plane with the lower end of the arm 4 in such position that the movement of the arm due to the angular movement of the lever 2 depresses the levers 10 and 11, and through the connecting links 12 and 13, pushes the armatures 19 and 20 away from their respective magnets, and elevates the inner ends of the latches 14 and 15 into a position to engage the lever 25. In the "normal" position of the lever 2 the arm stands over the lever 11, but the lever 10 is free and the armature 19 and latch 14 are free to move under the influence of the magnet 17. In the "reversed" position of the lever 2, the lever 10, the latch 14 and the armature 19 are locked by the arm 4, but the lever 11 the latch 15 and the armature 20 are free to move under the influence of the magnet 18.

The armatures 19 and 20 are connected rigidly to the same piece of non-magnetic metal 99 which is pivoted to the frame 1 at a point 100 midway between the magnets 17 and 18. The angle at which the armatures are placed is such that when both rods 21 and 22 are down in their lowest positions they will just touch the armatures 19 and 20 respectively and the said armatures will be equidistant from the magnets 17 and 18 respectively. When one armature is pulled up by its magnet the rod resting thereon will be pushed upward and the other armature will be pulled downward without moving its rod. This arrangement is for the purpose of preventing one armature being pulled up by its own magnet when the opposite magnet is energized the purpose of which will hereafter be seen.

To more fully explain the apparatus I will describe a complete cycle of movements of the lever 2 from normal to reverse. In Fig. 1 the lever is shown in the "normal" position.

The first movement then is to pull the lever 2 outwardly which rotates the link 3 to its middle position, moves the tappet 30 to its middle position and swings the lever 25 to its vertical position. The lever 25 in passing to its vertical position slides easily over the latch 14 depressing it out of its way, but is locked against any further movement by the latch 15. This movement of the lever 2 has separated the brushes 113 and 117 electrically by withdrawing the pins 114 and 116 from them. The next movement of the lever 2 is an angular movement around the pivot 102 to its lower position. By this movement the contact 34 carried by the arm 4 is moved into connection with the brushes 38 and 75, the contact 74 is made to connect the brushes 39 and 76 and the arm 4 is carried away from the lever 11 and over the lever 10 thereby depressing the lever 10 and raising the inner end of the latch 14, if not already in that position, so as to lock the lever 25 against movement to its original position. In this last named position of the lever 2 the spring 6 tends to push it inwardly in a longitudinal direction and exerts a pressure through the link 3 and bar 29 on the lever 25, causing it to press against the latch 15 which is still in engagement with it, held by the weight of the parts 11, 13 and 22. The lever 25 being so locked also locks the tappet 30 in its middle position. If now a current is caused to circulate in the coils of the magnet 18 the armature 20 will be attracted and the latch 15 will thereby be disengaged from the lever 25 and under the influence of the spring 6, the lever 2 will be pushed into complete reversed position. This movement will act on the link 3 and, through the bar 29, will push the tappet bar into complete reversed position. At the same time the lever 25 is swung out of the vertical position to a position inclined to the vertical equal to that shown, but on the opposite side of the vertical. In this last named position of the lever 2 the brushes 113 and 117 are again electrically connected.

The movement from "reversed" to "normal" is exactly similar to that just described and can be readily understood without further description.

In Fig. 4 the parts 44, 45, 46, 47, 48, 49 and 50 and 51 are parts of the well known switch and lock movement which it will not be necessary to describe in detail here. Reciprocal motion is imparted to the bar 45 by means of a reversible electrical motor 42 geared to it by any suitable means. I have shown in Fig. 4 a screw as being the means employed for converting the rotary motion of the armature into a longitudinal movement of the bar 45.

An automatic circuit controller for controlling the circuit to the switch operating motor and the indication magnets is the only part of the apparatus needing special description. As is well known the bar 45 moves longitudinally in one direction to close and lock the rail switch and in the opposite direction to open and lock the switch. The circuit controller as shown comprises a bar 54, pivoted arms 55 and 56, contact plates 69 and 70, and brushes 61, 62, 63, 64, 65, 66 and and 67, all contained in a case 58. The bar 54 is connected rigidly to the bar 45 by means of an arm 53, and slides in guides formed in the case 58 as it follows the movements of the bar 45. The bar 54 carries a pin 57 which engages with jaws 109 and 110 formed on the arm 55, near one of the extreme positions of said bar and with the jaws 111 and 112 formed on the arm 56, near the other extreme position. Brushes 61 and 63 are supported on a block 59. The brushes 62 and 64 are supported on a block 60 and the brushes 65, 66 and 67 are supported on a block 68. The blocks 59, 60 and 68 are formed of insulating material and are supported by the case 58. The contact plates 69 and 70 are carried by the arms 55 and 56 respectively and are insulated electrically from the said arms.

To describe the operation of the circuit controller I will assume the apparatus as shown in Figs. 4 and 8, to be in the "normal" position. In this position the contact plate 69 connects the brushes 61 and 63, and the contact plate 70 connects the brushes 66 and 67. Immediately after the movement towards "reverse" position begins, the pin 57 strikes the jaw 111 pushes it out of its path and turns the arm 56 on its pivot so as to carry the contact plate 70 away from the brushes 66 and 67 and put it into connection with the brushes 62 and 64. This movement of the plate 70 is effected before the lock bolt is withdrawn from the lock rod 49. Near the end of the movement of the bar 54 the pin 57 strikes the jaw 110 and turns the arm 55 on its pivot, which carries the contact plate 69 away from the brushes 61 and 63 and puts it into connection with the brushes 65 and 67. This movement of the plate 69 is made after the lock bolt has entered the lock rod 49 and the contact plate 69 is made wide enough so that it connects the brushes 65 and 67 before it leaves the brushes 61 and 63. The movement of the arm 55 just mentioned carries the jaw 109 into the return path of the pin 57. It will be noticed from the preceding that during the entire movement except near the beginning and end, the contact plate 69 has connected the brushes 61 and 63, and the contact plate 70 has connected the brushes 62 and 64 and that the brushes 65 and 66 have been disconnected from the brush 67.

In moving the switch to the "normal" position the actions of the parts will be exactly similar to those above described and

can be readily understood from what has been said in describing the "reverse" movement.

I will now describe the electrical connections between the apparatus in the cabin and that at the switch and show how the movement of the switch is effected and indication of its position given, reference being made chiefly to Fig. 5. In this 77 is the armature of the switch operating motor, 78 and 79 are field magnet energizing coils, 87 is a battery or other source of electrical energy and 71 is the rail switch. The parts are all shown in the "normal" position.

To reverse switch 71 its controlling lever 2 is first pulled out to avoid the lug 8, this movement effecting the locking of other conflicting levers as before described, and then pushed down to its lower angular position. The latter movement carries the contact 34 away from the brushes 36 and 72 and puts it into connection with the brushes 38 and 75 and carries the contact 74 away from the brushes 37 and 73 and puts it into connection with the brushes 39 and 76. In the position of the lever now being considered the spring 6 tends to push it inwards but it is locked against movement by the latch 15 engaging with the lever 25 as before described. The brushes 39 and 76 being joined by the contact 74 closes a circuit of the battery 87 so that current flows from said battery through wire 88, fuse 89, wire 90, brush 76, contact 74, brush 39, wires 96, 93, magnet 17, wire 82, brush 63, contact 69, brush 61, wire 80, field coil 78, armature 77, wires 85 and 86 back to battery. This current energizes the switch operating motor and causes its armature to rotate and through the intermediate gearing to move the rail switch. Shortly after the commencement of the movement, the contact 70 is removed from the brushes 66 and 67 and placed so as to connect the brushes 62 and 64 as before described. This does not open or close an electric circuit with the lever in the "reversed" position and is only a preliminary to a movement of the switch in the opposite direction and to forming the indication circuit. Near the end of the movement now being considered, the contact plate 69 is separated from the brushes 61 and 63 and is put into connection with the brushes 65 and 67 as before described. This opens the "reverse" operating circuit above described, thereby stopping the flow of current from the battery through the motor and forms the indication circuit including the field coils 78 and 79 and the indication magnet 18 so that the current induced in the said field coils by the decreasing magnetism flows from field coil 79 through wire 81, brush 62, contact 70, brush 64, wire 83, magnet 18, wire 92, brush 75, contact 34, brush 38, wire 84, brush 67, contact 69, brush 65, wire 80 to field coil 78, thence to field coil 79, the two coils being joined and acting jointly to produce the current. The current flowing in this last named circuit energizes the indication magnet 18 causing it to attract its armature and thereby causes the disengagement of the latch 15 and lever 25 and releases the lever 2 and tappet 30 to go to full "reverse" position as before described.

To throw the rail switch back to "normal" position the lever 2 is put into its upper angular position in which position the contacts 34 and 74 stand as shown in Fig. 5. This closes a circuit of the battery 87 so that current flows from said battery through wire 88, fuse 89, wires 90, 91, brush 36, contact 34, brush 72, wires 95, 92, magnet 18, wire 83, brush 64, contact 70, brush 62, wire 81, field coil 79, armature 77, wires 85, and 86 back to battery 87. This operating current flows through the field coil 79 while that before described for the "reverse" movement of the switch flowed through the field coil 78. These currents flow around the field magnets so as to magnetize them oppositely while both flow through the armature 77 in the same direction. The armature therefore rotates in the opposite direction when the field coil 79 is energized to that in which it would rotate if the field coil 78 is energized. The current in the last named circuit therefore causes the armature to rotate so as to move the rail switch by means of the intermediate gearing, towards the "normal" position. Shortly after the movement commences the contact 69 is moved from the brushes 65 and 67 and put into connection with the brushes 61 and 63 and near the end of the movement the contact 70 is moved from the brushes 62 and 64 to the brushes 66 and 67. The movement of the contact 70 breaks the "normal" operating circuit, the last one described above, and closes the indication circuit including the field coils 78 and 79 and the indication magnet 17 so that the current induced in the said field coils by the decreasing magnetism flows from field coil 78 through wire 80, brush 61, contact 69, brush 63, wire 82, magnet 17, wire 93, brush 37, contact 74, brush 73, wires 94, 84, brush 67, contact 70, brush 66, wire 81, field coils 79 and 78 to beginning. This current energizes the magnet 17, causing it to attract the armature 19 and thereby disengaging the latch 14 from the lever 25 which permits the lever 2 and tappet 30 to move into full "normal" position.

It has before been mentioned that the contact plate 69 is wide enough to make contact with the brushes 65 and 67 before leaving the brushes 61 and 63. The object of this is to close the indication circuit before the operating circuit is opened and so permit the full force of the induction to be spent in the indication circuit. It also prevents arcing to a

considerable extent at the break in the operating circuit. The same remarks apply to the contact 70 and the brushes with which it connects.

It will be noticed from the circuits described above that the "reverse" operating current passes through the coils of the magnet 17. The object of this is to hold the armature 19 and thus prevent the armature 20 being moved prematurely by a current in the magnet 18 which is the indication magnet for the "reverse" movement. No current can flow in the magnet 18 in the "reverse" movement until the proper indication current is generated unless the indication wire 84 should happen to be crossed with the wire 86 or some wire connected to it. If this should happen there would be a shunt around the switch operating motor armature so that current would leave the operating circuit at field coil 78 pass through field coil 79, wire 81, brush 62, contact 70, brush 64, wire 83, magnet 18, wire 92, brush 75, contact 34, brush 38, wire 84, thence through the cross to wire 86 and to battery 87. Since the whole current the operating current through the armature 77 and that through the shunt just mentioned passes through the magnet 17 and only the part through the shunt through the magnet 18, the magnet 18 cannot pull the armature away from the magnet 17, and therefore cannot give an indication. Similarly in making the "normal" movement the operating current goes through the coils of the magnet 18 for the same purpose.

It has been noticed that during the entire movement except a small part near the beginning or end of the movement the contact 69 connects the brushes 61 and 63 and the contact 70 connects the brushes 62 and 64. By reference to the operating circuits traced above it will be seen that this arrangement makes it possible to change the direction of rotation of the switch motor armature at will by merely changing the position of the corresponding lever 2 at any time in the "normal" or "reverse" movement except a small part at the beginning of each movement. This exception is unimportant since the part of the movement when the motor is not reversible is so small that the lock bolt will not have been withdrawn from the lock rod. In this connection one of the advantages of obtaining the indication current from the induction of the field magnet over other methods is that if the lever has been moved by mistake and before the armature has time to start and move the switch perceptibly the mistake is discovered and the lever put back an indication will be received and the lever can be pushed home in its original position, which is proper since if the switch has not moved the lever should go home to correspond with it. Another advantage is that the indication current is always of the same strength no matter whether the armature is running fast or slow.

The object of the circuit closer composed of the brushes 113, 117, the pins 114, 116, and the strip 115 is the following: As before noted the brushes 113 and 117 are electrically connected when the lever 2 is in complete "normal" or "reverse" position. When so connected the brushes 38 and 73 are connected to the common wire 86 through wire 98. For convenience I will assume the common wire 86 to be connected to the negative of the battery. As one terminal of the switch operating motor is permanently connected to the common wire the other terminal must be connected to a wire from the positive to cause rotation. Consequently, if current reaches the motor on account of crossed wires the wires crossed must be the next operative wire of the motor in question and a wire from the positive of the battery. In the position of the apparatus shown in Fig. 5 the next operative wire for switch 71 is 82. If we assume that the positively charged wire 83 is crossed with 82 a circuit of battery 87 would be from said battery through wire 88, fuse 89^a, wires 90^a and 91^a, brush 36^a, contact 34^a, brush 72^a, wires 95^a, 92^a, magnet 18^a, wire 83^a, the cross, wire 82, magnet 17, wire 93, brush 37, contact 74, brush 73, wires 94, 97, brush 113, wire 115, brush 117, and wire 98 back to battery 87. This circuit would be of such low resistance that the fuse 89^a would be blown before current that would reach the motor armature 77 would be effective in moving the switch 71. As all positive wires are provided with fuses at the point of connection with the positive bus bar the result would be the same should any other wire be crossed with 82. In the "reverse" position of switch 71 the wire 83 is the next operative and is connected to the negative through the magnet 18, wire 92, brush 75, contact 34, brush 38, wire 97, brush 113, wire 115, brush 117, and wire 98, so that a cross between it and any positive wire would form a short circuit that would blow the fuse in the positive wire crossed with it.

Having thus described my invention I claim as new and desire to secure by Letters Patent—

1. In railway switching apparatus, the combination of a source of electric energy, a switch operating motor having one terminal of its armature connected to the middle point of the field coil or series of coils, suitable mechanism actuated by the said motor for moving and locking the rail switch, a conductor connecting the other terminal of the said armature with one pole of the source of energy, two other conductors, a manual two position circuit controller for connecting either of said two other conductors with the other pole of the said source of energy, an

automatic circuit controller actuated by said mechanism for connecting the non-charged one of said two other conductors to a terminal of said field coil or series of coils at the beginning of the movement of said mechanism and for disconnecting the charged one of said two other conductors from the other terminal of the said field coil or series of coils at the end of the movement of said mechanism, substantially as and for the purpose specified.

2. In railway switching apparatus, the combination of a source of electric energy, a switch operating motor comprising two field coils, suitable mechanism actuated by the said motor for moving and locking the rail switch, a manual controller, an automatic controller actuated by said mechanism, a switch operating circuit including one field coil of the said motor and the said source of energy, an indication magnet, and an indication circuit including a field coil of said motor and the coil of said indication magnet in which current is caused to circulate by the inductive action of the field magnet of the said motor produced by the coil in the operating circuit on the said field coil in the indication circuit, substantially as and for the purpose specified.

3. In railway switching apparatus, the combination of a source of electric energy, a switch operating motor having one terminal of its armature joined to the middle point of the field winding and the other terminal connected to a pole of the source of energy, suitable mechanism actuated by said motor for moving and locking the rail switch, a manual two position circuit controller for connecting either terminal of said field winding with the other pole of the said source of energy, an indication magnet, and an automatic controller actuated by said mechanism for connecting said indication magnet to and disconnecting said source of energy from said field winding, substantially as and for the purpose specified.

4. In railway switching apparatus, the combination with interlocking mechanism of a switch operating motor comprising two field coils, mechanism actuated by said motor for moving and locking the rail switch, a source of electric energy, two operating circuits each of which includes a field coil of the motor, a two position circuit controller, a lever susceptible of an initial movement, a medial movement, and a final movement, a latch for holding said lever against final movement, an arm for causing said latch to lock said lever, an indication magnet for disengaging said latch and releasing said lever, an indication circuit including the coil of said magnet and a field coil of said switch operating motor wherein current to energize said magnet is generated by the inductive action of the field magnet of said motor on said field coil, substantially as and for the purpose specified.

5. In railway switching apparatus the combination with interlocking mechanism of a switch operating motor, mechanism actuated by said motor for moving and locking the rail switch, a source of electric energy, an operating circuit including said motor and said source of energy, an indication circuit in which current is caused to flow by the inductive action of the field magnet on the field coil of said motor, an automatic circuit controller actuated by said switch operating mechanism, a lever having initial, medial, and final movements, a circuit controller actuated by the medial movement of said lever, latches for locking said lever against final movement, an arm for causing said latches to lock said lever, electro-magnets for causing the disengagement of said latches, the said magnets having interlocked armatures and being alternately one in the said operating circuit and the other in said indication circuit, substantially as and for the purpose specified.

6. In railway switching apparatus the combination with interlocking mechanism, of a source of electric energy, a motor, switch operating mechanism actuated by said motor, electrical connections between said motor and said source of energy, a lever having initial, medial and final movements, a latch for locking said lever against final movement, an arm to cause said latch to lock said lever, an electro-magnet for causing the disengagement of said latch, electrical connections between said magnet and the field coil of said motor, and a circuit controller actuated by the final movement of said lever for closing the said motor on short circuit, substantially as and for the purpose specified.

7. In a railway switching apparatus, the combination of a mechanism operated by an electric motor for moving switch rails, two circuits and a source of electrical supply for said motor each of which circuits comprise a field coil of the motor and armature thereof, a lever for controlling said circuit, a lock for said lever comprising an electro-magnet, and a circuit for said electro-magnet which includes the field coil of the motor and not energized by current from the source of electrical supply.

8. In a railway switching apparatus, the combination of a mechanism operated by an electric motor for moving switch rails, two circuits and a source of electrical supply for said motor each of which circuits comprise a field coil of the motor and the armature thereof, a lever for controlling said circuits, a lock for said lever comprising an electro-magnet, a circuit for said electro-magnet which includes the field coil of the motor and

not energized from the source of electrical supply, and a circuit controller operated upon a complete movement of the switch rails for opening the circuit on the motor and for closing a circuit on the electro-magnet of the lock.

9. In a railway switching apparatus, the combination of a mechanism operated by an electric motor for moving switch rails, said motor comprising at least two field coils each of which is in series with the armature of the motor, circuits and a source of electrical supply for said motor, a manually operated circuit controller for said circuits, a lock for said manually operated circuit controller comprising electro-magnetic means, and a circuit for said electro-magnetic means which includes a field coil of the motor and in which circuit flows current generated by the inductive action of the field magnet of the motor on the said field coil.

10. In a railway switching apparatus, the combination of a mechanism operated by an electric motor for moving switch rails, said motor comprising at least two field coils each of which is in series with the armature of the motor, circuits and a source of electrical supply for said motor, a manual controller for said circuits which controller when operated closed the circuit for one of the field coils and armature, a lock for said manual controller comprising electro-magnets, and a circuit for each electro-magnet which includes a field coil of the motor in which circuit current flows generated by the inductive action of the field magnet of the motor on the field coil of the motor.

11. In a railway switching apparatus, the combination of a mechanism operated by an electric motor for moving switch rails, said motor comprising at least two field coils each of which is in series with the armature of the motor, circuits and a source of electrical supply for said motor, a manual controller for said circuit, which controller when operated closes the circuit for one of the field coils, a lock for said manual controller comprises electro-magnets and a circuit for each electro-magnet which includes a field coil of the motor in which circuit a current flows generated by the inductive action of the field magnet of the motor on the field coil of the motor, and a circuit controller operated from the motor for opening the circuit on the motor and inclosing the circuit including an electro-magnet.

12. In a railway switching apparatus, the combination with a source of electric energy, a switch operating motor having at least two field coils each of which is in series with the armature and one terminal of the armature connected to one pole of the source of energy, suitable mechanism actuated by said motor for moving the switch rails, a manual circuit controller operated by said manual controller for short-circuiting the motor upon a cross in the wires.

13. In a railway switching apparatus, the combination with an interlocking mechanism, of a source of electric energy, a motor operated thereby for moving switch rails, electrical connections between said motor and said source of energy, a lever for controlling said electrical connections, a latch for locking said lever against final movement, an electro-magnet for causing a disengagement of said latch, electrical connections between said magnet and the field coils of said motor, and a circuit controller for short circuiting said motor upon a cross of wires.

14. In a railway switching apparatus, the combination of a source of electric energy, a switch operating motor having at least two field coils each of which is in series with the armature, suitable mechanism actuated by said motor for moving switch rails, a conductor for connecting one pole of the source of electric energy with a coil, two other conductors, a manual controller for connecting either of said conductors with the other pole of the said source of energy with the motor, and a circuit controller actuated by said mechanism for connecting the noncharged one of said two other conductors to one of said field coils at the beginning of the movement of said mechanism and for disconnecting the charged one of said two other conductors from the other terminal of said field coil or series of coils at the end of the movement of said mechanism.

15. In a railway switching apparatus, the combination with interlocking mechanism of a switch operating motor, mechanism actuated by said motor for moving switch rails, a source of electric energy, operating circuits, a circuit controller, a lever susceptible of initial movement, a (medial) movement, and a final movement, a latch for holding said lever against final movement, an indication magnet for disengaging said latch and releasing said lever, an indication circuit including the coil of said magnet and the field coil of said switch operating motor wherein current to energize said magnet is generated by the inductive action of the field magnet of said motor on said field coil.

16. The combination of a plurality of motor actuated mechanisms for moving switch rails, a plurality of levers for controlling the supply of power to said mechanisms, each of said levers having a longitudinal movement and an oscillatory movement, and mechanical interlocking between said levers which is released and locked by longitudinal movements of the levers.

17. The combination of electric motor operative mechanisms for moving switch rails, a source of electrical supply, connections between said supply and electric motors of the mechanisms, levers for controlling the

connections, and circuit controllers operated by the levers for short-circuiting the motors upon a cross of wires between the source of electric supply and the motors.

18. The combination in an interlocking machine for switches and signals with a plurality of levers each having preliminary and final longitudinal movements and an angular movement between the preliminary and final longitudinal movements, of mechanical interlocking operated by the lever during its preliminary and final longitudinal movements.

19. The combination in an interlocking machine for switches and signals with a plurality of levers each having preliminary and final longitudinal movements and an angular movement between the preliminary and final longitudinal movements, of mechanical interlocking operated by the lever during its preliminary and final longitudinal movements, and means for preventing angular movements of the lever before making a longitudinal movement.

20. The combination in an interlocking machine for switches and signals with a plurality of levers 2 each having preliminary and final longitudinal movements and an angular movement between the two longitudinal movements, of mechanical interlocking operated by each lever 2 during its preliminary and final longitudinal movements, and an electric lock for each lever 2 comprising a lever 25, two latches and electro-magnetic means for operating them, the arrangement being such that upon the preliminary longitudinal movement of a lever 2 the lever 25 is moved to a position to be engaged by the two latches which then act to prevent further longitudinal movement of the lever 2 until either of them is moved by its electro-magnetic means.

21. The combination in an interlocking machine for switches and signals with a plurality of levers 2 each having preliminary and final longitudinal movements and an angular movement between the two longitudinal movements, of a circuit controller operated by the lever during its angular movement, mechanical interlocking operated by each lever 2 during its preliminary and final longitudinal movements, and an electric lock for each lever 2 comprising a lever 25, two latches and electro-magnetic means for operating them the arrangement being such that upon the preliminary longitudinal movement of a lever 2 the lever 25 is moved to a position to be engaged by the two latches which then act to prevent further longitudinal movement of the lever 2 until either of them is moved by its electro-magnetic means.

22. The combination in an interlocking machine for switches and signals of a plurality of levers 2 each provided with a slot, a pivot for each lever 2 located in the slot of each lever about which the lever has longitudinal and angular movements, a link of an interlocking mechanism associated with each lever, an electric lock for each lever comprising a lever 25 operated by each link, a pair of latches which act to hold the lever 25 against movement after its preliminary movement, and an electromagnet for moving each latch to permit further movement of the lever 25 with its lever 2.

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Witnesses:
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