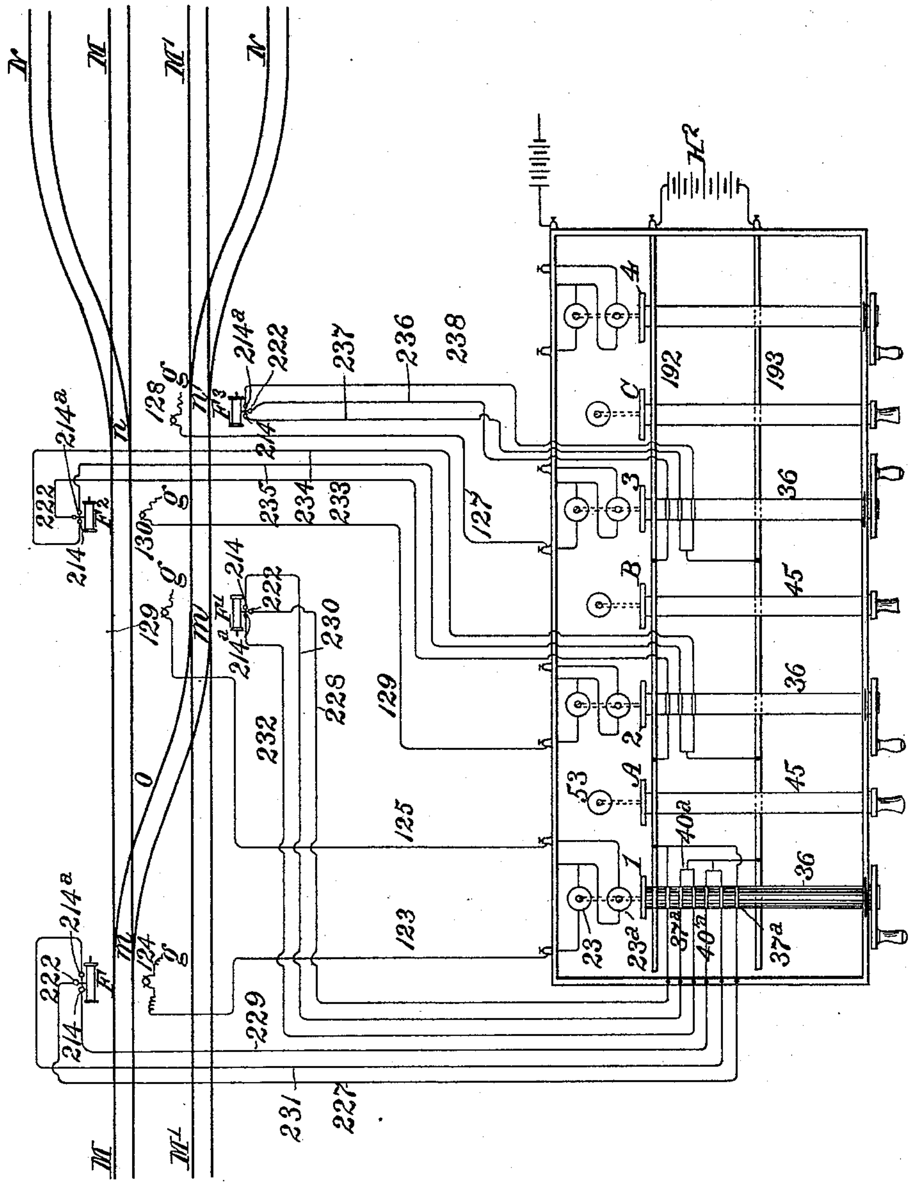
(No Model.) 5 Sheets—Sheet 1.

J. G. L. SCHREUDER.

SWITCH AND SIGNAL APPARATUS.

No. 479,666. Patented July 26, 1892.

FIG. 1.



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(No Model.) 5 Sheets—Sheet 2.

J. G. L. SCHREUDER.

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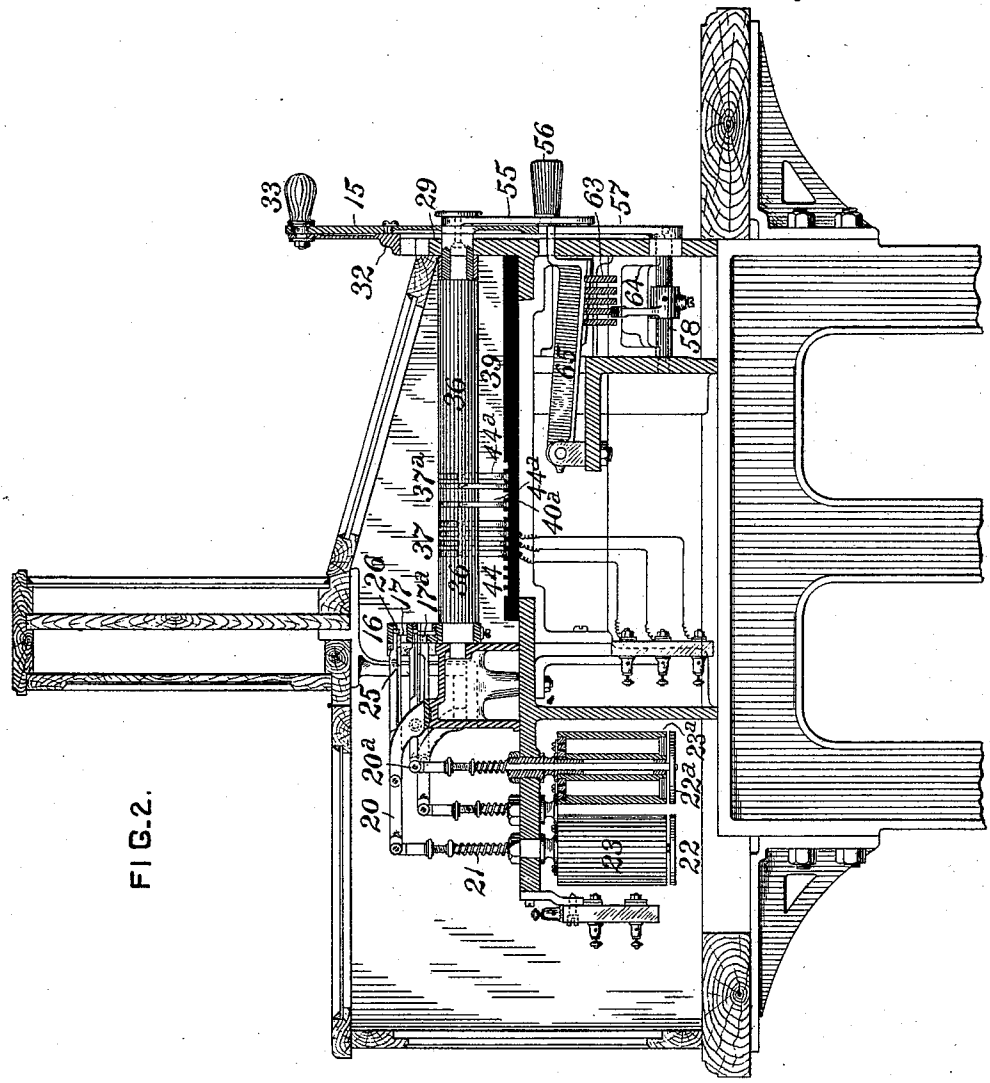

FIG. 2.

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(No Model.) 5 Sheets—Sheet 3.

J. G. L. SCHREUDER.

SWITCH AND SIGNAL APPARATUS.

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FIG. 3.

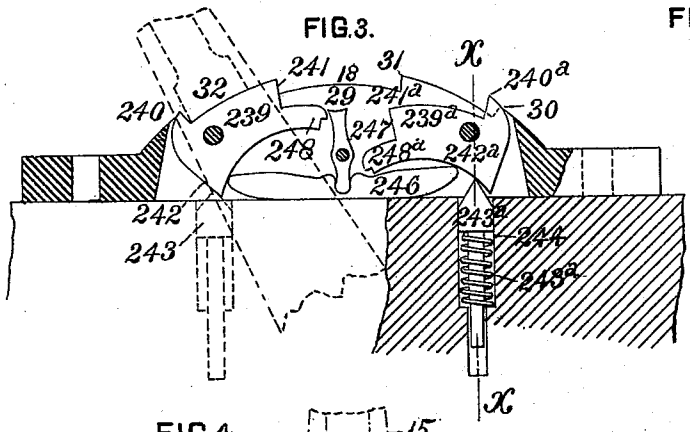


FIG. 6.

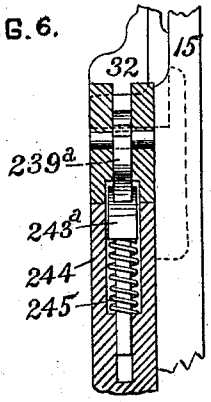


FIG. 4.

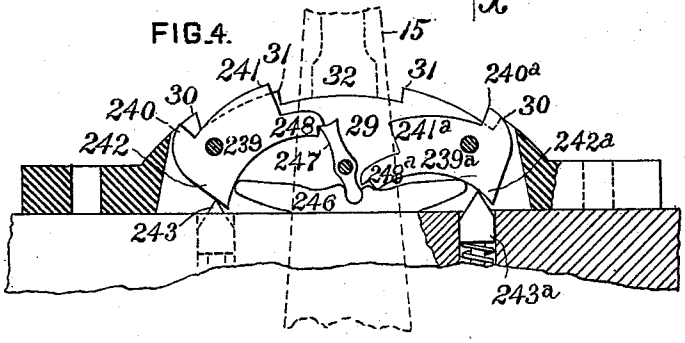
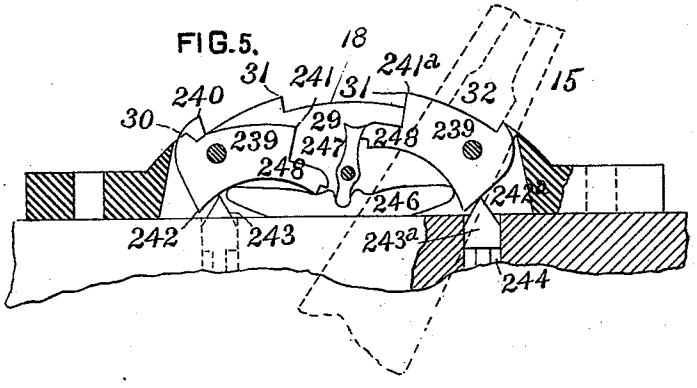


FIG. 5.



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J. G. L. SCHREUDER.

SWITCH AND SIGNAL APPARATUS.

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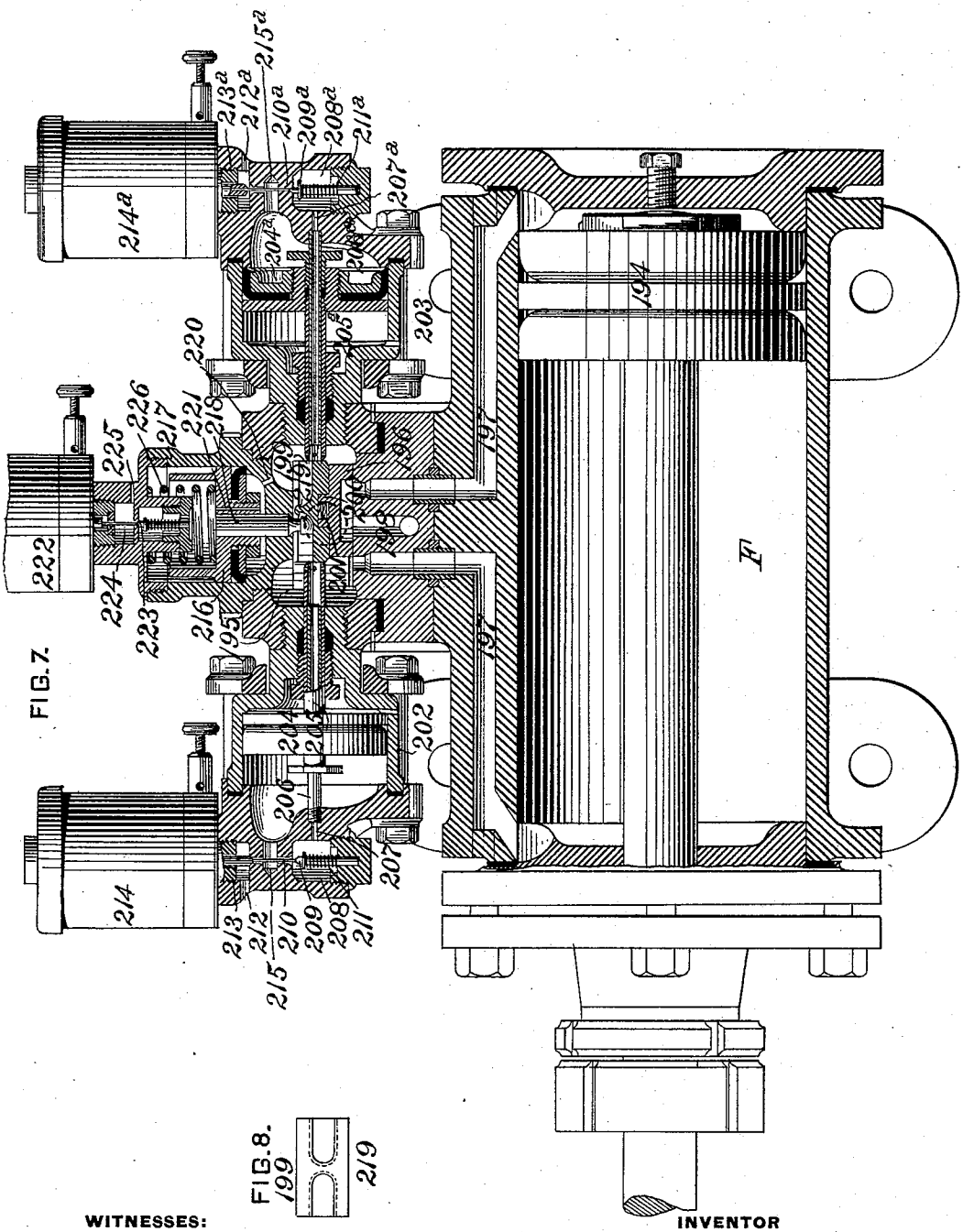

FIG. 7.

FIG. 8.

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SWITCH AND SIGNAL APPARATUS.

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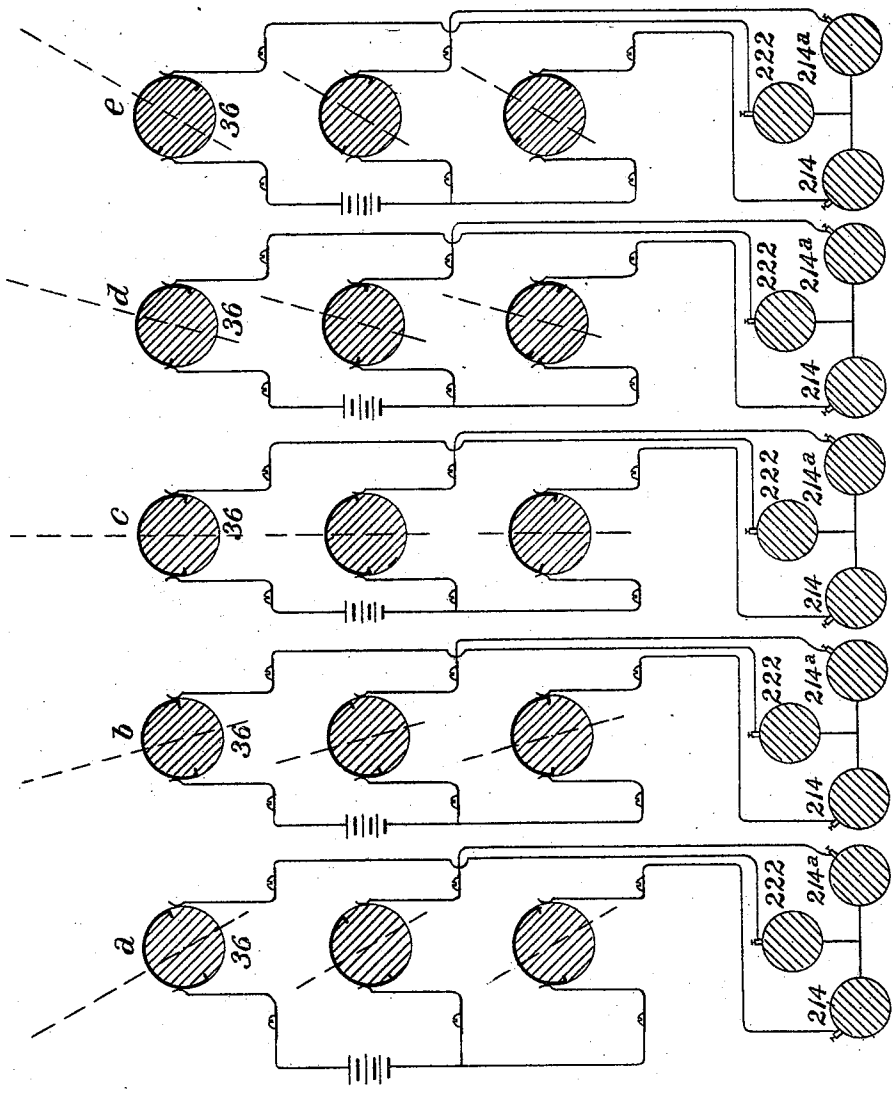

FIG. 9.

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UNITED STATES PATENT OFFICE.

JENS G. L. SCHREUDER, OF EDGEWOOD, PENNSYLVANIA.

SWITCH AND SIGNAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 479,666, dated July 26, 1892.

Application filed June 10, 1891. Serial No. 395,771. (No model.)

To all whom it may concern:

Be it known that I, JENS G. L. SCHREUDER, a subject of the King of Sweden and Norway, residing at Edgewood, in the county of Allegheny and State of Pennsylvania, have invented or discovered certain new and useful Improvements in Switch and Signal Apparatus, of which improvements the following is a specification.

The invention described herein relates to certain improvements in the switch and signal apparatus described and claimed in an application filed March 19, 1888, and numbered serially 267,710, patented February 10, 1891, under No. 446,159, and in Letters Patent No. 357,109, to Geo. Westinghouse, Jr., dated February 1, 1887. In the plant or apparatus set forth in said Letters Patent the motor for operating the switch or other part or appliance connected with the track is provided with a fluid-pressure-controlled valve mechanism, and from said valve mechanism two lines of pipe, which are kept constantly charged with a liquid, and also a third line of pipe constantly charged with a fluid under pressure for operating the piston of the motor extend to a valve mechanism in the machine, located in the signal-tower, the latter valve mechanism being constructed to control the application of fluid-pressure to the liquid column in one line of pipe and to relieve the pressure from the other line of pipe, in accordance with the required movements of the switch. As a triple line of pipe is required for each independently-operating switch and as the switches are frequently located at a considerable distance from the signal-tower, the expense of erecting and maintaining such a plant is considerable, it being necessary that the pipes leading to the valve mechanism of the motor should be kept constantly charged with some liquid non-congealable at low temperature.

The object of the present invention is to provide for the more effective controlling of the motor-valve by means of electric currents passing through electro-magnets forming part of the valve mechanism of the motor and controlled by make-and-break mechanism in the machine in the tower, thereby avoiding the great expense involved in the employment of the double line of valve-controlling pipes and effecting a quicker action of the switches at a distance from the tower.

In the accompanying drawings, forming a part of this specification, Figure 1 is a diagrammatic view showing a section of double tracks and branch lines from each main line, together with mechanism for operating the switches and the electric circuits extending from the switch mechanisms to the machine in the tower. Fig. 2 is a sectional elevation of the machine, showing the make-and-break mechanism controlling the circuits leading to one of the switch mechanisms. Figs. 3, 4, and 5 are sectional detail views of locking mechanism for the switch-controlling lever. Fig. 6 is a sectional view on the line $x\,x$, Fig. 3. Fig. 7 is a sectional elevation of the switch-operating mechanism. Fig. 8 is a detail view of the valve-cap, and Fig. 9 is a diagrammatic view illustrating the orderly sequence in which the circuits leading to the switch-motor are completed and broken by the movement of the switch-lever.

The machine shown in Fig. 2 is constructed as described and shown in the patent hereinbefore referred to, except that the valve mechanism controlling the flow of fluid pressure to the pipes leading to the motor-valve mechanism are omitted. The rollers 36, formed of insulating material, are provided with axial shafts, which have the journals at their ends mounted in suitable bearings. The axial shafts of the rollers 36 are provided at their outer ends with operating levers or handles 15 and at their inner ends with locking-quadrants 16, which operate, in connection with the safety-latches 20, controlled by electro-magnets 23, to insure orderly step-by-step movement of the rollers 36, said latches serving as indicators as to the movements of the switch-rails, as fully described in said patent. The levers 15 are provided on their rear sides with sliding latches 32, adapted to engage shoulders 30 and 31, formed on the curved segments 29 on the upper edge of the front plate of the machine. As described in said patent, the distance between the shoulders 30 of the segments is equal to the length of the slots 17 of the quadrants 16 and the distance between the shoulders 31 is equal

to the length of the notches 18 of said quadrants.

The mechanical interlocking mechanism between the signal-levers 55 and the switch-levers 15, consisting of the bars 63 and dogs 65, is constructed and operated as described in said patent.

A bed-plate 39, of rubber, hard wood, or other suitable insulating material, is secured to the frame of the machine beneath the rollers 36 and 45, the latter being employed to control the signals, as described in said patent. In addition to metallic strips 40, forming a part of the signal and locking circuits, a number of metallic strips 40^a is arranged on the bed-plate 39, said strips 40^a being made in two parts or sections, which are arranged on opposite sides of each switch-controlling roller 36, as shown in Fig. 1. The inner adjacent ends of each section are provided with metallic springs 44^a, arranged to bear upon the rollers 36, in line with bands 37^a, so that in certain predetermined positions of the rollers the strips 40^a, springs 44^a, and bands 37^a will form complete metallic circuits. The outer ends of the sections forming the strips 40^a on one side of each of the rollers 36 are connected by wires to electro-magnets on the switch-operating motors F, F′, F^2, and F^3, while the outer ends of the sections of said strips are connected to bars 192 and 193, which are connected to opposite poles of the battery H^2, as shown in Fig. 1. It will be understood that the bands 37^a on the rollers 36 are in addition to the bands 37, which form, as described in said patent, parts of the signal and locking circuits in certain positions of the rollers 36.

The pistons 194 of the motors F, F′, F^2, and F^3 are connected in any suitable manner to the movable switch-rails. As shown in Fig. 7, a valve-chamber 195 is arranged on the cylinder of each motor, and within said chamber is arranged a valve 196, adapted, as hereinafter described, to regulate the flow of fluid-pressure from the valve-chamber, which is connected to a constant supply of fluid-pressure by a pipe entering the chamber, as indicated in dotted lines, to the ports 197, leading to opposite ends of the cylinder, and the exhaust from said cylinder through the port 198. The valve is held to its seat by a cap 199, provided on its under side with a transverse recess for the reception of a corresponding rib 200, formed on the upper side of the valve. This cap is interposed between the valve and the lower end of a cylinder screwed into the top of the valve-chamber, and between the valve and cap is placed a spring 201, adapted to hold the valve closely to its seat in case of wear. Cylinders 202 and 203 are arranged on opposite sides of the valve-chamber, said cylinders being provided with threaded plugs at their inner ends, adapted to screw into the ends of the valve-chamber. The pistons 204 of said cylinders are provided with tubular rods 205, passing through suitable stuffing-boxes into the valve-chamber, their inner ends engaging or bearing against opposite ends of the valve or its cap 199.

Within the piston-rods 205, which have their inner ends perforated for the admission of fluid-pressure from the valve-chamber, are placed tubes 206, which, extending through the pistons 204, have their outer ends secured in passages 207, communicating with chambers 208 in the heads of the cylinders 202 and 203, thus permitting fluid-pressure in the valve-chamber to flow freely to the chambers 208. Within the chambers are arranged valves 209 for controlling the flow of fluid-pressure through ports 210 into the outer ends of the cylinders 202 and 203, and these valves are normally held to their seats by springs 211, surrounding the stems of the valves. The outer ends of the cylinders 202 and 203 are connected with the open air by ports 212, and the escape of fluid-pressure is controlled by valves 213, which are connected with the armatures of the electro-magnets 214 and 214^a.

Between the valves 209 and 213 are interposed pins 215, which are made of such a length that when one of said valves is on its seat the other valve will be held away from its seat—as, for example, if the electro-magnet 214 be excited its armature will be moved down, thereby pressing the valve 213 to its seat, closing the exhaust-port 212, and the downward movement of the valve 213 will through the medium of the pin 215 unseat the valve 209, thereby permitting fluid-pressure to flow into the outer end of the cylinder 202 and move its piston to the right, as shown. At the same time, the electro-magnet 214^a being demagnetized, the spring 211^a will seat the valve 209^a, thereby unseating the valve 213^a and permitting fluid-pressure to escape from the cylinder 203.

In order to prevent an accidental displacement of the valve 196, the piston 216 within the cylinder 217 on top of the valve-chamber 195 is provided with a pin 218, projecting down into the valve-chamber and adapted to engage a shoulder 219, formed centrally on the upper side of the cap 199 by cutting recesses longitudinally of the cap, as shown in Figs. 7 and 8. The cylinder 217 is connected by a port 220 with the valve-chamber 195 for the admission of fluid-pressure thereinto, and a small passage 221 is formed through the piston 216, so as to equalize fluid-pressure on both sides of the piston, which is normally held so that the pin 218 will be in engagement with the valve 196 or the cap thereon by the spring 226. When it is desired to release the valve 196, the electro-magnet 222 is excited, thereby so shifting its armature as to depress the valve 223 through the medium of the pin 224, thereby opening the exhaust-port 225 and permitting the escape of fluid-pressure from the upper end of the cylinder. The exhaust-port 225 being larger than the passage 221, the excess of pressure on the

under side of the piston will force the latter up, thereby releasing the valve 196. As soon as the magnet 222 is demagnetized the valve 223 is returned to its seat, closing the exhaust-port, and as soon as the pressure on both sides is equalized, or partially so, the spring 226 will so shift the piston 216 as to cause the pin 218 to engage the valve 196.

Referring now to Fig. 1, the circuits leading from the rollers 36 of the machine to the magnets 214, 214ª, and 222 are as follows, and for convenience it will be supposed that the magnet 214 is the one employed in closing the switch, so as to give clear main line, and will be termed the "closing-magnet," and the magnet 214ª is the one employed in opening the switch to the branch or siding and will be termed the "opening-magnet." The magnet 222 will be termed the "locking-magnet."

As the switches *m m'* are at the ends of the cross-over O, between the main tracks M M', they are operated at the same time and are controlled by the same roller 36 of the machine. The circuits from the locking-magnets 222 of the motors F F' are formed by the wires 227 and 228, and their strips 40ª on the machine are connected to the bar 192, which is connected to one pole of the battery H². The circuits from the closing-magnets 214 of the motors F F' are formed by the wires 229 and 230, while the circuits for the opening-magnets 214ª are formed by the wires 231 and 232. The strips 40ª, to which these wires are connected, are in turn connected to the bar 193, leading from the opposite pole of the battery H². As the locking-magnets of both motors are electrically connected to the closing and opening magnets 214 and 214ª, as indicated in Figs. 1 and 9, a complete metallic circuit is formed when the roller 36, whose bands 37ª form parts of said circuits, has been properly adjusted. The locking-circuit for the motor F² is formed by the wire 233, and its band 40ª is connected to the bar 192, and the closing and opening circuits of the same motor are formed by the wires 234 and 235, their bands 40ª being connected to the bar 193. These circuits are controlled by the roller 36ª. The locking, closing, and opening circuits of the motor F³ are formed by the wires 236, 237, and 238 and are controlled by the roller 36ᵇ. The locking-circuit 236 is connected by its strip 40ª to the bar 192, and the closing and opening circuits 237 and 238 are connected by their strips to the bar 193.

While the three bands 37ª for any one switch are arranged on the same roller, as shown in Fig. 1, for convenience of description and illustration three sections of one roller are represented in the several views contained in Fig. 9, said views showing the different positions of the bands 37ª from normal (when the switch is closed to clear main line) to the opposite position, when the switch is open for siding or branch line.

Referring now to Figs. 7 and 9, the operation involved in shifting a switch is as follows: The upper roller in each view in Fig. 9 having the band for the locking-circuit, the middle roller having the band for the opening circuit, while the band for the closing-circuit is on the lower roller, it will be observed that in view *a*, Fig. 9, the roller 36 is in such position as to break the circuits leading to the locking, closing, and opening magnets. On rotating the roller to the right the bands on the upper and lower rollers are first brought into contact with the contact-springs on the right of the rollers, those on the left being already in contact, thereby closing the circuits through the closing and locking magnets 214 and 222. The purpose of thus closing the circuit of the closing-magnet, thereby admitting air into the cylinder 202, is to shift the valve 196 to the right, (see Fig. 7,) so as to disengage its cap from the locking-pin, if the valve has been accidentally shifted as to cause the undercut portion of the cap to engage the locking-pin. The completion of the circuit through the locking-magnet 222 opens the exhaust-valve 223, thereby permitting the fluid-pressure on the under side of the piston 216 to raise it and lift the locking-pin 218 out of engagement with the valve 196 or its cap 199. As the roller continues to rotate the band on the lower roller is moved out of contact with its spring on the left and the band on the middle roller is brought into contact with its spring on the right; but the band on the middle roller remains in contact with both of its springs, as shown in views *c* and *d*, Fig. 9. The breaking of the circuit through the closing-magnet 214 closes the inlet-port 210 and opens the exhaust-port 212 of the cylinder 202, while closing the circuit through the opening-magnet 214ª so shifts the valves 209ª and 213ª as to close the exhaust-port 212ª and open the inlet-port 210ª, thereby admitting fluid-pressure into the cylinder 203 and shifting the piston 204ª. This movement of the piston 204ª shifts the valve 196 to the left, thereby opening the port 197ª and connecting the port 197 with the exhaust-port 198, with the effect of shifting the piston 194 of the motor to the left, so as to open the switch to the siding or branch line. As the roller 36 completes its rotation to the right, as shown in view *e*, Fig. 9, the bands on the upper and middle rollers are moved out of contact with their springs on the left, thereby breaking the circuits through the opening and locking magnets 214ª and 222. When the circuit through the locking-circuit is thus broken, the valve 223 is closed by its spring, and as soon as the pressure on both sides of the piston 216 becomes sufficiently equalized the spring 226 forces the piston inwardly, thereby causing the pin 218 to engage the valve 196 or the cap thereon.

The magnets 23 23ª, controlling the locking and indicating latches 20, are included in the circuits formed by the wires 123, 125, 127, and

129, extending from the switch-locking device or some moving part of the switch, as described in said patent.

The locking and indicating latch 20 will permit of a movement of the roller 30 and its operating-lever 15 to the position indicated in view *d*, Fig. 9. When the roller 36 is in this position, the switch will have been shifted, but not locked, nor will the valve 196 have been locked, as described. Hence it may sometimes happen that an operator may shift the wrong lever 15 to or nearly to the position shown in view *d*, Fig. 9, and then before the latch 20 has operated to lock the lever as against a return movement of the lever the operator may discover his mistake and return the lever to the position indicated in view *a*, Fig. 9, and the return movement of the bar may be so rapid as not to afford sufficient time for the closing-magnet and the fluid-pressure mechanism controlled thereby to operate and shift the valve 196 to the right again. The result of such partial forward movement of the roller would be to shift the valve 196 to the left in the manner described, and as the return of the lever to normal position, at which position all circuits are broken, is so rapid that the valve is not returned to normal position the lever 15 will indicate by its position that the switch is set for clear main line, whereas the switch will be set for the siding or branch line.

In order to compel the operator to complete a movement of the switch-controlling lever after the movement has been once begun, curved locking-plates 239 239ª, provided with shoulders 240 and 241, are so pivoted to curved segments 29 on the front plate of the machine that said shoulders 240 and 241 will be in line with the shoulders 30 and 31 on the segments, the upper edges of the plates between the shoulders corresponding in curvature to the edges of the segments, as shown in Figs. 3, 4, and 5. On their lower edges and in line with their pivotal points the plates are provided with spurs 242, having inclined sides, with which wedge-shaped plungers 243 are arranged to engage. The stems of the plungers are arranged in sockets 244, formed in the front plate of the machine, and the plungers are held in engagement with the spurs by springs 245.

Between the spurs of the plates 239 and 239ª is placed a slide 246, having its ends bearing against the inner inclined walls of the spurs. At or near the middle of the slide is formed a notch for the reception of one end of a pivotally-mounted dog 247, the upper end of said dog being adapted to engage fingers 248 and 248ª on the inner ends of the plates, as hereinafter described. The lever 15 being to the left and the locking devices in the position shown in Fig. 3, their operation is as follows: As soon as the lever is shifted to its middle position, the latch 32 dropping in between the shoulder 31, the plate 239 will be turned to the position shown in Fig. 4 by the spring-plunger 243 bearing against the outer wall of the spur 242. The inward movement of the spur 242 shifts the slide 246 to the right, thereby turning the dog 247 so that its upper end will pass under the finger 248, thereby preventing any downward movement of the plate 239 until the dog is again shifted, as hereinafter described. The movement of the latch 32 is so limited that it can be raised only sufficiently far to clear the shoulder 31; but the turning of the plate 239 by the spring-plunger raises the shoulder 241 sufficiently far above the plane of the shoulder 31 that the latch cannot clear, thereby locking the lever 15 as against a return until the plate 239 is depressed. As will be seen in Figs. 3 and 4, the movement of the lever to the right may be continued by raising the latch 32 above the right-hand shoulder 31.

As shown in Figs. 3 and 4, the plate 239ª is turned down and held in such position by the spring-plunger 243ª bearing against the inner face of the spur 242ª that the shoulder 240ª will project beyond the shoulder 30. As the lever 15 is moved to its extreme right-hand position, as is necessary in order to break the circuits of the locking and opening magnets, as hereinbefore described, the latch 32 strikes against the shoulder 240ª and shifts the plate 239ª to the position shown in Fig. 5, thereby shifting the spur 242ª to the left side of the spring-plunger 243ª. This movement of the spur 242ª shifts the slide 246 to the left, and it in turn moves the dog 247 from under the finger 248 and pushes the spur 242 to the left side of the spring-plunger 243, which, bearing against the left face of the spur, turns the plate 239 down, so that the lever may be shifted to the left when desired, as shown in Fig. 5. When the lever is again moved to the left, the upward push of the plunger 243ª against the right face of the spur 242ª will as the latch 32 clears the shoulder 241ª turn the inner end of the plate up, shifting said shoulder to such a height that it cannot be cleared by the latch should the operator attempt to return the lever to the right. The movement of the spur 242ª, actuated by the plunger 243ª, shifts the slide 246 farther to the left, thereby shifting the upper end of the dog 247 under the finger 248ª, locking the plate 239ª as against any downward movement until the dog is shifted by a completion of the movement of the lever to the left.

It will be understood that the locking and signal circuits described in the patent hereinbefore referred to are employed in connection with the improvements described herein.

I claim herein as my invention—

1. The combination of a fluid-pressure motor for operating a switch or other part or appliance connected with a track and provided with an electrically-controlled valve mechan-

ism with an electrically-controlled lock for locking said valve mechanism and make-and-break mechanisms for controlling the circuits leading to the lock and valve mechanisms of the motor, substantially as set forth.

2. The combination of a fluid-pressure motor for operating a switch or other part or appliance connected with a track and provided with an electrically-controlled valve mechanism with a make-and-break mechanism for controlling the circuits leading to the valve mechanism of the motor and an electrically-operated mechanism for locking the make-and-break mechanism during the operation of the motor, substantially as set forth.

3. The combination of a fluid-pressure motor for operating a switch or some part or appliance connected with a track and provided with an electrically-controlled valve mechanism with an electrically-controlled lock for the valve mechanism of the motor, make-and-break mechanisms for controlling the circuits leading to the lock and valve mechanisms of the motor, and an electrically-controlled mechanism for locking the make-and-break mechanism during the operation of the motor, substantially as set forth.

4. The combination of a series of two or more fluid-pressure motors for operating a series of two or more switches or other parts or appliances connected with a track and provided with electrically-controlled valve mechanisms with electrically-controlled locks for the valve mechanisms and a make-and-break mechanism for controlling the circuits leading to the lock and valve mechanisms of the motors, substantially as set forth.

5. The combination of a series of two or more fluid-pressure motors for operating a series of two or more switches or other parts or appliances connected with a track and provided with electrically-controlled valve mechanisms with a make-and-break mechanism controlling the circuits leading to each of the valve mechanisms of the motors and electrically-operated mechanisms for locking the make-and-break mechanisms during the operation of the motors, substantially as set forth.

6. The combination of a lever for operating the make-and-break mechanism controlling the switch and a lock operated by the lever for preventing a partial forward-and-return movement of the lever, substantially as set forth.

7. The combination of a lever for controlling the movements of the switch, pivotal plates provided with shoulders adapted to engage the latch of said lever and having spurs with inclined faces, spring-actuated plungers adapted to engage said spurs, and a slide arranged between the spurs, substantially as set forth.

8. The combination of a lever for controlling the movements of the switch, pivotal plates provided with shoulders adapted to engage the latch of said lever and having spurs with inclined faces, spring-actuated plungers adapted to engage said spurs, a slide arranged between the spurs, and a dog operated by the slide and adapted to engage the pivotal plates, substantially as set forth.

9. In combination with a fluid-pressure cylinder and piston, a distributing-valve governing the supply and exhaust pistons to actuate said valve, electrically-actuated valves, each controlling the admission and exhaust of fluid-pressure to and from one side of each of said pistons, and a lock for holding the distributing-valve in different positions, substantially as set forth.

10. In combination with a fluid-pressure cylinder and piston, a distributing-valve governing the supply and exhaust, and a locking-pin for holding said valve in different positions, the pin and valve being provided with interlocking projections and recesses, substantially as set forth.

11. In combination with a fluid-pressure cylinder and piston, a distributing-valve governing the supply and exhaust, pistons to actuate said valve, electrically-actuated valves, each controlling the admission and exhaust of fluid-pressure to and from one side of each of said pistons, and an electrically-controlled locking device adapted to so engage the distributing-valve as to necessitate a preliminary shifting of the distributing-valve to permit of the withdrawal of the locking device, substantially as set forth.

In testimony whereof I have hereunto set my hand.

JENS G. L. SCHREUDER.

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R. H. WHITTLESEY.