May 9, 1933. H. L. BONE 1,908,504

APPARATUS FOR CONTROLLING RAILWAY SWITCHES

Original Filed Jan. 2, 1931

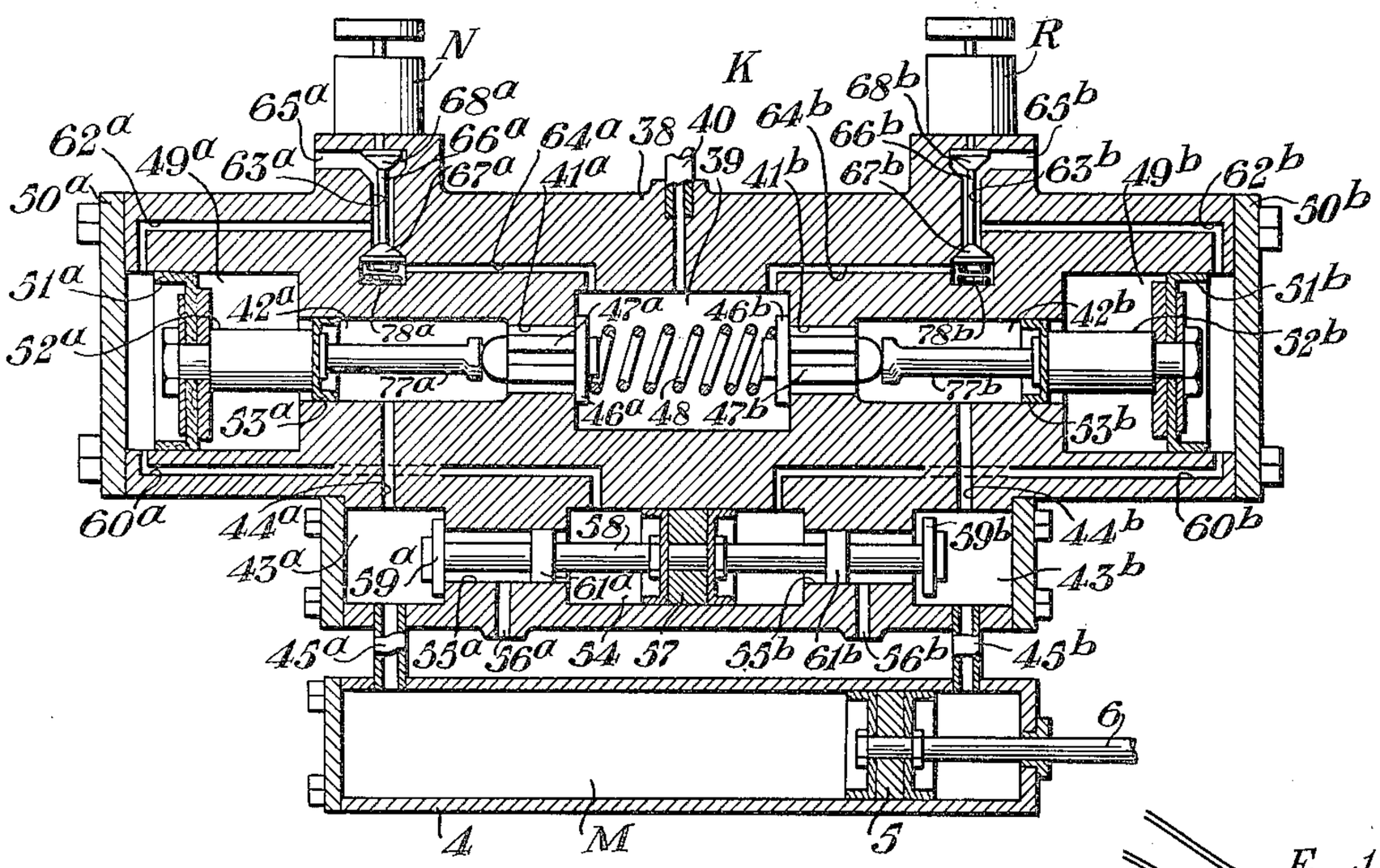

Fig. 2.

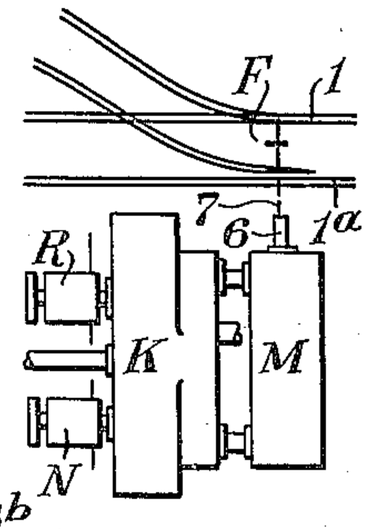

Fig. 1.

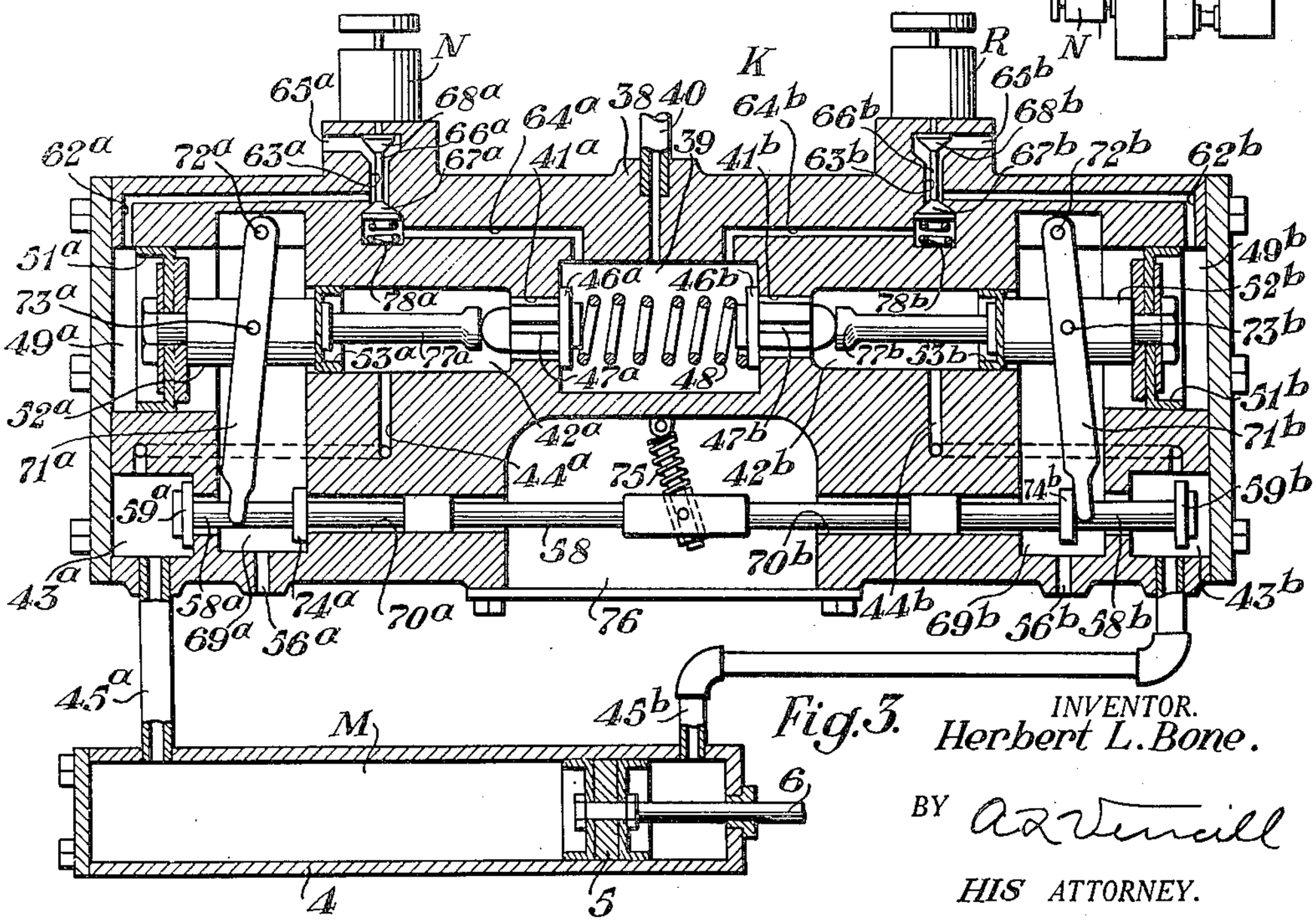

Fig. 3.

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UNITED STATES PATENT OFFICE

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APPARATUS FOR CONTROLLING RAILWAY SWITCHES

Original application filed January 2, 1931, Serial No. 506,061, now Patent No. 1,895,067, dated January 24, 1933. Divided and this application filed April 23, 1932. Serial No. 607,157.

My invention relates to apparatus for controlling railway switches, and particularly to apparatus of this type which is operated by fluid pressure.

The present application is a division of my copending application, Serial No. 506,061, filed Jan. 2, 1931, Patent 1,895,067 Jan. 24, 1933, for Apparatus for controlling railway switches.

I will describe two forms of apparatus embodying my invention, and will then point out the novel features thereof in claims.

In the accompanying drawing, Fig. 1 is a view, partly diagrammatic, and partly in side elevation, showing a railway switch operated by a fluid pressure motor controlled by one form of switch valve embodying my invention. Fig. 2 is a vertical sectional view of the switch valve illustrated in Fig. 1. Fig. 3 is a similar view showing a modified form of the switch valve illustrated in Figs. 1 and 2, and also embodying my invention.

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

Referring first to Fig. 1, the reference characters 1 and 1ª designate the rails of a stretch of railway track which is provided with a switch F of the usual and well-known form. This switch is operated between normal and reverse positions by a motor M which, in the form shown in detail in Figs. 2 and 3, comprises a cylinder 4 containing a reciprocable piston 5. Attached to the piston 5 is a plunger 6 which is operatively connected with the movable points of the switch F through suitable mechanism which is indicated in the drawing by the dotted line 7. Fluid under pressure, usually compressed air, is at times supplied to one end or the other of the cylinder 4 from a suitable source not shown in the drawing, and the supply of such fluid pressure is controlled by a switch valve K embodying my invention, the construction and operation of which I will describe presently. For clearness, the valve K is shown in Fig. 1 as being disposed upon its side at a right angle to its preferred operating position and embodies in its construction a normal magnet N and a reverse magnet R which, when energized, selectively permit fluid under pressure to enter one end of the cylinder 4 to move the switch F to its normal position or to enter the other end of the cylinder 4 to move the switch to its reverse position, respectively. The magnets N and R may be controlled in any suitable manner, one form of apparatus for controlling these magnets being described and claimed in my copending application, Serial No. 506,061, of which the present application is a division.

Referring now to Fig. 2 in which one form of the valve device K is illustrated in detail, as here shown, the valve device K comprises a casting 38 formed with a centrally located fluid pressure supply chamber 39 which communicates through a pipe 40 with a suitable source of fluid under pressure, and through openings 41ª—41ᵇ in its opposite walls, with a pair of valve chambers 42ª—42ᵇ. A pair of outlet chambers 43ª—43ᵇ communicate with the valve chambers 42ª—42ᵇ, respectively, through passageways 44ª—44ᵇ, and also with the switch operating cylinder 4 at each end thereof through pipes 45ª—45ᵇ. Communication between the pressure supply chamber 39 and the valve chambers 42ª—42ᵇ and consequently with the outlet chambers 43ª—43ᵇ, respectively, is controlled by inlet valves 46ª—46ᵇ which are provided with ribbed stems 47ª—47ᵇ slidably mounted in the openings 41ª—41ᵇ and which are biased toward closed positions by a coiled spring 48 interposed between the valves 46ª—46ᵇ within the supply chamber 39.

A pair of fluid pressure cylinders 49ª—49ᵇ are arranged in axial alignment with each other adjacent each end of the device K, the outer ends of which are closed by cylinder heads 50ª—50ᵇ. Pistons 51ª—51ᵇ are mounted for reciprocation within the cylinders 49ª—49ᵇ, respectively, and are provided with plungers 52ª—52ᵇ having portions 77ª—77ᵇ which extend inwardly through the valve chambers 42ª—42ᵇ for engagement with rounded outer ends of the valve stems 47ª—47ᵇ of the inlet valves 46ª—46ᵇ. Communication between the inner ends of the cylinders 49ª—49ᵇ and the valve chambers 42ª—42ᵇ is prevented by relatively small pistons 53ª—53ᵇ carried by the plungers 52ª—52ᵇ for reciprocation within

the valve chambers between the cylinders 49^a—49^b and the outlet passageways 44^a—44^b.

A fluid pressure cylinder 54 is formed in the casting 38 between the outlet chambers 43^a—43^b, with its longitudinal axis spaced from and parallel to the axis of the cylinders 49^a—49^b and is provided with openings 55^a—55^b in its end walls which extend to the outlet chambers 43^a—43^b. Communication is, at times, established between the outlet chambers 43^a—43^b and the outer atmosphere, through exhaust ports 56^a—56^b which communicate with the openings 55^a—55^b. A piston 57 is mounted for reciprocation within the cylinder 54 and carries a rod 58 which extends in opposite directions through the openings 55^a—55^b and into the outlet chambers 43^a—43^b and carries, at its outer ends, outlet valve members 59^a—59^b which control communication between the outlet chambers 43^a—43^b and the exhaust ports 56^a—56^b. Passageways 60^a—60^b establish communication between opposite ends of the fluid pressure cylinder 54 and the pressure side of the cylinders 49^a—49^b but communication between the cylinder 54 and the exhaust ports 56^a—56^b is prevented by relatively small pistons 61^a—61^b carried by the rod 58 for reciprocation within the openings 55^a—55^b between the cylinder 54 and the exhaust ports 56^a—56^b.

The pistons 51^a—51^b are forced inwardly to open the inlet valves 46^a—46^b, respectively, against the action of the spring 48 by fluid pressure admitted into the cylinders 49^a—49^b through passageways 62^a—62^b which extend inwardly and communicate with vertically extending passageways 63^a—63^b. The passageways 63^a—63^b communicate at their lower ends with the pressure supply chamber 39 through passageways 64^a—64^b and at their upper ends with the outer atmosphere through exhaust ports 65^a—65^b. Valve stems 66^a—66^b extend vertically through the passageways 63^a—63^b and are provided at their lower ends with normally closed lower valves 67^a—67^b which control communication between the passageways 64^a—64^b and the vertical passageways 63^a—63^b. The valve stems 66^a—66^b are also provided at their upper ends with normally open upper valves 68^a—68^b which control communication between the vertical passageways 63^a—63^b and the exhaust ports 65^a—65^b. The valves 67^a—67^b are urged toward a closed position and the valves 68^a—68^b are biased toward an open position by springs 78^a—78^b. The valve stems 66^a—66^b are operated by the normal and reverse magnets N and R respectively which are suitably mounted on the top of the casting 38.

With the parts in the positions shown in the drawing, the piston 5 has been shifted to the right in order to move the switch F to its normal position, and the normal and reverse magnets N and R are both deenergized, thereby permitting the lower valves 67^a—67^b to close and the upper valve 68^a—68^b to open. This interrupts communication between the pressure supply chamber 39 and both of the cylinders 49^a—49^b but establishes communication between these cylinders and the outer atmosphere, thus permitting the spring 48 to close the inlet valves 46^a—46^b and to yieldably hold the valve operating pistons 51^a—51^b in their outer positions. Also, it will be noted that, with the switch F in its normal position, the piston 57 occupies a position to the right of the center so as to close the outlet valve 59^a and open the outlet valve 59^b.

I will now assume that it is desired to move the switch F to its reverse position. To do this, the reverse magnet R is energized. This closes the upper valve 68^b, which interrupts communication between the cylinder 49^b and the outer atmosphere, and opens the lower valve 67^b, which establishes communication between the pressure supply chamber 39 and the cylinder 49^b through the passageways 62^b, 63^b and 64^b. Fluid pressure, thus admitted to the cylinder 49^b, forces the piston 51^b to the left, as viewed in the drawing, and opens the inlet valve 46^b against the action of the spring 48, thereby establishing communication between the supply chamber 39 and the right-hand end of the switch operating cylinder 4. During these operations fluid under pressure in the cylinder 49^b has been admitted to the right-hand portion of the cylinder 54 and shifts the piston 57 to the left, thereby closing the outlet valve 59^b and opening the outlet valve 59^a. This establishes communication between the left-hand portion of the switch operating cylinder 4 and the outer atmosphere through the pipe 45^a, outlet chamber 43^a, opening 55^a, and exhaust port 56^a. The piston 5 is thus forced to the left and moves the switch F to its reverse position. When the reverse movement of the switch is completed the reverse magnet R is automatically deenergized in any suitable manner forming no part of my present invention, and therefore not shown in the drawing, so that the lower valve 67^b becomes closed and the upper valve 68^b becomes opened. Communication is then interrupted between the pressure supply chamber and the cylinders 49^b and 54, and both of these cylinders are vented to atmosphere through the exhaust port 65^b. The spring 48 is thus permitted to return the inlet valve 46^b to its normally closed position, thereby interrupting communication between the pressure supply chamber 39 and the switch operating cylinder 4.

It will be noted, however, that the outlet valve 59^b remains in the closed position to which it was moved and is held in such position by the fluid under pressure which is trapped in the switch operating cylinder 4 and the outlet chamber 43^b. Also, it will be

noted that the fluid under pressure thus trapped in the cylinder 4 positively tends to maintain the switch in the position to which it was last moved and that any leakage of fluid pressure by the inlet valve 46^b will be into the pressure side of the cylinder 4. This tends to replace the fluid under pressure that may leak from the cylinder 4. Moreover, in the present device fluid under pressure is cut off from the switch operating cylinder 4 except when the switch is being moved between its normal and reverse positions. This results in a material saving of air.

The operation of the device in moving the switch F back to its normal position is the same as that above described but in a reverse order and will be understood without further description.

In Fig. 3, I have shown another embodiment of my invention in which I employ lever mechanism instead of fluid pressure means for operating the outlet valves 59^a—59^b. In this particular construction, the valve chambers 42^a—42^b and the inner ends of the cylinders 49^a—49^b open into lever chambers 69^a—69^b interposed therebetween and through which the inlet valve operating plungers 52^a—52^b extend. Also, in this form of the device, the rod 58 is slidably mounted in guideways 70^a—70^b formed in the lower portion of the casting and extends through the lower portions of the lever chambers 69^a—69^b, through the openings 58^a—58^b and into the outlet chambers 43^a—43^b. Communication between the outlet chambers 43^a—43^b and the outer atmosphere is obtained through the openings 58^a—58^b and through the exhaust ports 56^a—56^b which in this case communicate with the lower portions of the lever chambers 69^a—69^b.

The rod 58 is shifted longitudinally in order to open and close the outlet valves 59^a—59^b by depending levers 71^a—71^b which are pivotally mounted at their upper ends in the upper end of the chambers 69^a—69^b, as at 72^a—72^b, and which are pivotally connected intermediate of their ends with the plungers 52^a—52^b, as at 73^a—73^b. The lower ends of the levers 71^a—71^b are adapted to engage collars 74^a—74^b carried by the rod 58 so that when the pistons 51^a—51^b are forced inwardly by fluid pressure their motion will be transmitted to and cause a corresponding movement of the rod 58 and the outlet valves 59^a—59^b carried thereby. The rod 58 is yieldably maintained in the position to which it is moved by a suitable toggle device 75 which is disposed within a chamber 76 located between the guideways 70^a—70^b and beneath the pressure supply chamber 39. It will be noted from an inspection of Fig. 3, that the levers 71^a—71^b function to shift the position of the outlet valves 59^a—59^b only when the pistons 51^a—51^b are forced inwardly and that when the pistons are returned to their normal positions under the action of the spring 48, the lower ends of the levers 71^a—71^b move out of engagement with the collars 74^a—74^b without transmitting any motion to the rod 58, which is maintained by the toggle device 75 in the position to which it was last moved.

The operation of the device above described is substantially the same as that described in connection with the structure disclosed in Fig. 2, and a brief description is therefore deemed sufficient. With the parts in the positions shown in Fig. 3, if it is desired to move the switch F to its reverse position, the reverse magnet R is energized as before. This opens the valve 67^b and thus admits fluid under pressure into the cylinder 49^b which forces the piston 51^b inwardly thereby opening the inlet valve 46^b. The inward movement of the piston 51^b swings the lever 71^b about its pivot 72^b in a clockwise direction which in turn shifts the rod 58 longitudinally to the left through its engagement with the collar 74^b. This closes the outlet valve 59^b and opens outlet valve 59^a, thereby venting the left-hand portion of the switch operating cylinder 4 to atmosphere. The opening of the inlet valve 46^b admits fluid under pressure from the supply chamber 39 into the valve chamber 42^b, thence through the passageway 44^b into the outlet chamber 43^b, and thence through the pipe 45^b into the right-hand end of the switch operating cylinder 4, thereby forcing the piston 5 to the left and moving the switch to its reverse position. The operation of the device for a movement of the switch to its normal position is identically the same as that above described but in a reverse order.

From the foregoing, it will be apparent that I have provided an apparatus that is relatively simple in operation and construction and by means of which the loss of fluid under pressure through leakage is reduced to a minimum.

Although I have herein shown and described only two forms of apparatus embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In combination with a railway track switch, a fluid pressure device comprising a cylinder, a piston in said cylinder for moving said switch between normal and reverse positions, a fluid pressure supply chamber, a first outlet chamber communicating with said cylinder on one side of said piston, and also with the outer atmosphere, a second outlet chamber communicating with said cylinder on the other side of said piston, and also with the outer atmosphere, a first inlet valve

for controlling communication between said supply chamber and said first outlet chamber, a second inlet valve arranged in axial alignment with said first inlet valve for controlling communication between said supply chamber and said second outlet chamber, a spring interposed between said inlet valves for biasing said inlet valves toward closed positions, a first valve operating cylinder, a first valve operating piston in said first valve operating cylinder for opening said first inlet valve against the action of said spring, a second valve operating cylinder arranged in axial alignment with said first valve operating cylinder, a second valve operating piston in said second valve operating cylinder for opening said second inlet valve against the action of said spring, a first central valve for selectively establishing communication between said first valve operating cylinder and said supply chamber and between said first valve operating cylinder and the outer atmosphere, a second control valve for selectively establishing communication between said second valve operating cylinder and said supply chamber and between said second valve operating chamber and the outer atmosphere, a rod mounted for reciprocation on an axis spaced from and parallel to the axis of said valve operating pistons, a first outlet valve on one end of said rod for controlling communication between said first outlet chamber and the outer atmosphere, a second outlet valve on the other end of said rod for controlling communication between said second outlet chamber and the outer atmosphere, and means operable when said first valve operating piston is operated to open said first inlet valve for sliding said rod in one direction to simultaneously close said first outlet valve and open said second outlet valve and when said second valve operating piston is operated to open said second inlet valve for sliding said rod in an opposite direction to simultaneously close said second outlet valve and open said first outlet valve.

2. A fluid pressure control device comprising a fluid pressure supply chamber, a first outlet chamber communicating with the outer atmosphere and with said supply chamber, a second outlet chamber communicating with outer atmosphere and with said supply chamber, a first inlet valve for controlling communication between said supply chamber and said first outlet chamber, a second inlet valve for controlling communication between said supply chamber and said second outlet chamber, a first valve operating cylinder, a first valve operating piston in said first valve operating cylinder for opening said first inlet valve, a second valve operating cylinder arranged in axial alignment with said first valve operating cylinder, a second valve operating piston in said second valve operating cylinder for opening said second inlet valve, a first control valve for selectively establishing communication between said first valve operating cylinder and said supply chamber and between said first valve operating cylinder and the outer atmosphere, a second control valve for selectively establishing communication between said second valve operating cylinder and said supply chamber and between said second valve operating cylinder and the outer atmosphere, a third valve operating cylinder disposed in laterally spaced relation to said first and second valve operating cylinders and communicating at one end with said first valve operating cylinder and at the other end thereof with said second valve operating cylinder, a third piston in said third valve operating cylinder, a rod carried by said third piston and extending through opposite ends of said third cylinder, a first outlet valve on one end of said rod for controlling communication between said first outlet chamber and the outer atmosphere and a second outlet valve on the other end of said rod for controlling communication between said second outlet chamber and the outer atmosphere.

3. A fluid pressure control device comprising a fluid pressure supply chamber, a first outlet chamber, communicating with the outer atmosphere, and with said supply chamber, a second outlet chamber communicating with outer atmosphere and with said supply chamber, a first inlet valve for controlling communication between said supply chamber and said first outlet chamber, a second inlet valve for controlling communication between said supply chamber and said second outlet chamber, a first valve operating cylinder, a first valve operating piston in said first valve operating cylinder for opening said first inlet valve, a second valve operating cylinder arranged in axial alignment with said first valve operating cylinder, a second valve operating piston in said second valve operating cylinder for opening said second inlet valve, a first control valve for selectively establishing communication between said first valve operating cylinder and said supply chamber and between said first valve operating cylinder and the outer atmosphere, a second control valve for selectively establishing communication between said second valve operating cylinder and said supply chamber and between said second valve operating cylinder and the outer atmosphere, a rod mounted for movement in spaced parallel relation to the axis of said cylinders, a first outlet valve on one end of said rod for controlling communication between said first outlet chamber and the outer atmosphere, a second outlet valve on the other end of said rod for controlling communication between said second outlet chamber and the outer atmosphere, first lever mechanism operable by

said first piston for moving said rod in one direction to close said first outlet valve and open said second outlet valve, a second lever mechanism operable by said second piston for moving said rod in an opposite direction to close said second outlet valve and open said first outlet valve, and means for selectively controlling communication between said supply chamber and said cylinders and between said cylinders and the outer atmosphere.

4. In combination with a fluid pressure motor containing a reciprocable piston, a fluid pressure control device comprising a fluid pressure supply chamber, a first inlet valve for controlling communication between said supply chamber and one end of said fluid pressure motor, a second inlet valve for controlling communication between said supply chamber and the other end of said motor, means for biasing said inlet valves toward closed positions, a first valve operating cylinder, a first valve operating piston in said first valve operating cylinder operatively connected with said first inlet valve for opening said first inlet valve, a second valve operating cylinder, a second valve operating piston in said second valve operating cylinder operatively connected with said second inlet valve for opening said second inlet valve, a first outlet valve for controlling communication between said one end of said fluid pressure motor and atmosphere, a second outlet valve for controlling communication between said other end of said fluid pressure motor and atmosphere, means for selectively establishing communication between said supply chamber and said first valve operating cylinder and between said first valve operating cylinder and atmosphere, other means for selectively establishing communication between said supply chamber and said second valve operating cylinder and between said second valve operating cylinder and atmosphere, and means effective when said first valve operating piston is operated to open said first inlet valve for simultaneously closing said first outlet valve and opening said second outlet valve and when said second valve operating piston is operated to open said second inlet valve for simultaneously closing said second outlet valve and opening said first outlet valve.

5. In combination with a fluid pressure motor containing a reciprocable piston, a fluid pressure control device comprising a fluid pressure supply chamber, a first inlet valve for controlling communication between said supply chamber and one end of said fluid pressure motor, a second inlet valve for controlling communication between said supply chamber and the other end of said motor, means for biasing said inlet valves toward closed positions, a first valve operating cylinder, a first valve operating piston in said first valve operating cylinder operatively connected with said first inlet valve for opening said first inlet valve, a second valve operating cylinder, a second valve operating piston in said second valve operating cylinder operatively connected with said second inlet valve for opening said second inlet valve, a first outlet valve for controlling communication between said one end of said fluid pressure motor and atmosphere, a second outlet valve for controlling communication between said other end of said fluid pressure motor and atmosphere, two electropneumatic valves, means controlled by one of said electropneumatic valves for selectively establishing communication between said supply chamber and said first valve operating cylinder and between said first valve operating cylinder and atmosphere, means controlled by the other electropneumatic valve for selectively establishing communication between said supply chamber and said second valve operating cylinder and between said second valve operating cylinder and atmosphere, and means effective when said first valve operating piston is operated to open said first inlet valve for simultaneously closing said first outlet valve and opening said second outlet valve and when said second valve operating piston is operated to open said second inlet valve for simultaneously closing said second outlet valve and opening said first outlet valve.

In testimony whereof I affix my signature.

HERBERT L. BONE.