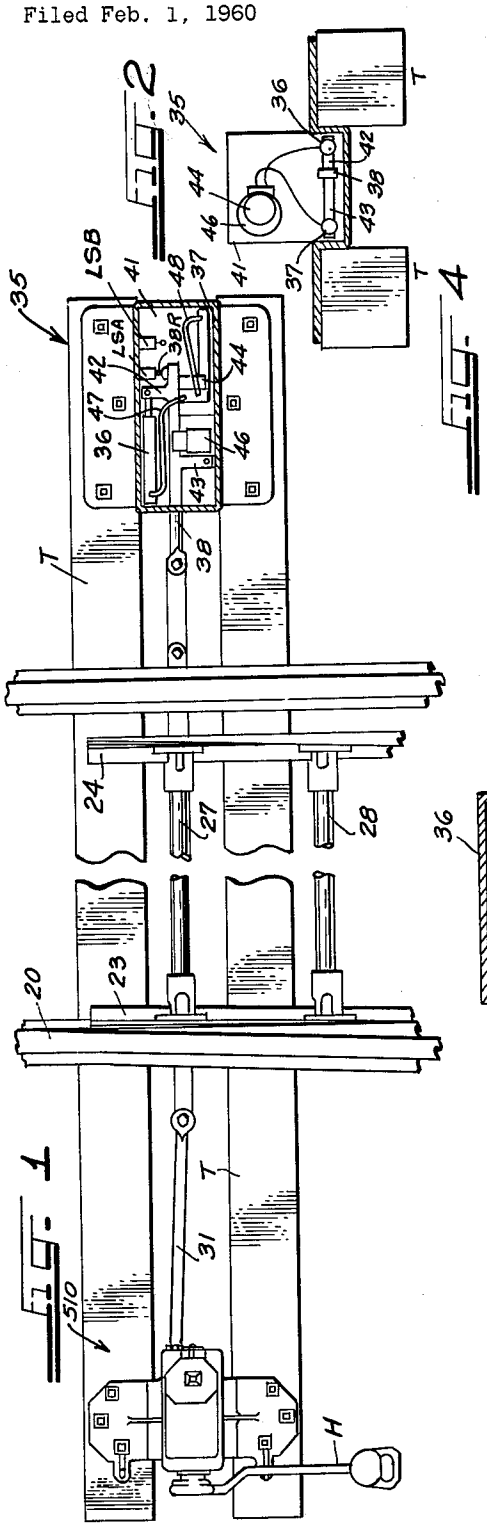
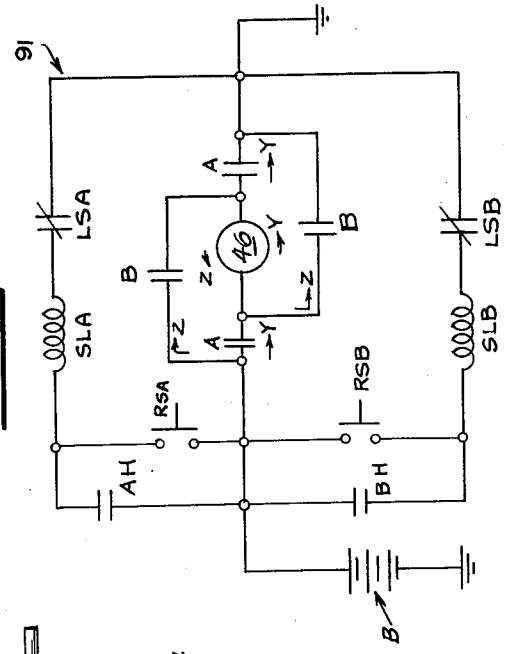
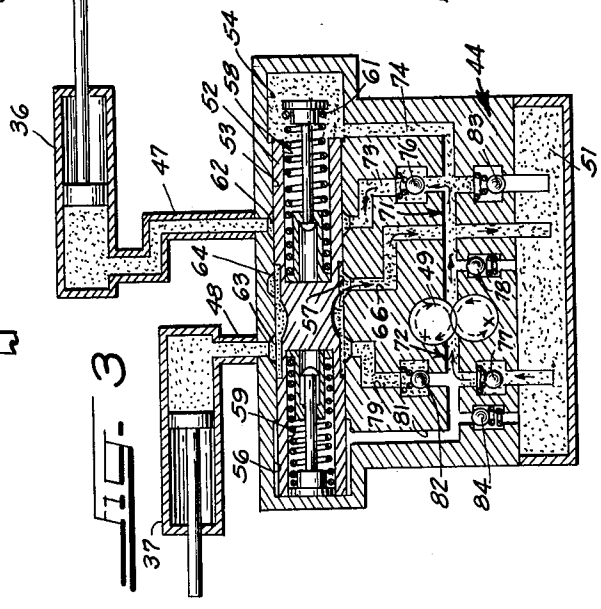
June 9, 1964 O. F. MAGNUS 3,136,509

RAILROAD SWITCH MECHANISMS

Filed Feb. 1, 1960 2 Sheets-Sheet 1







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RAILROAD SWITCH MECHANISMS

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FIG. 5

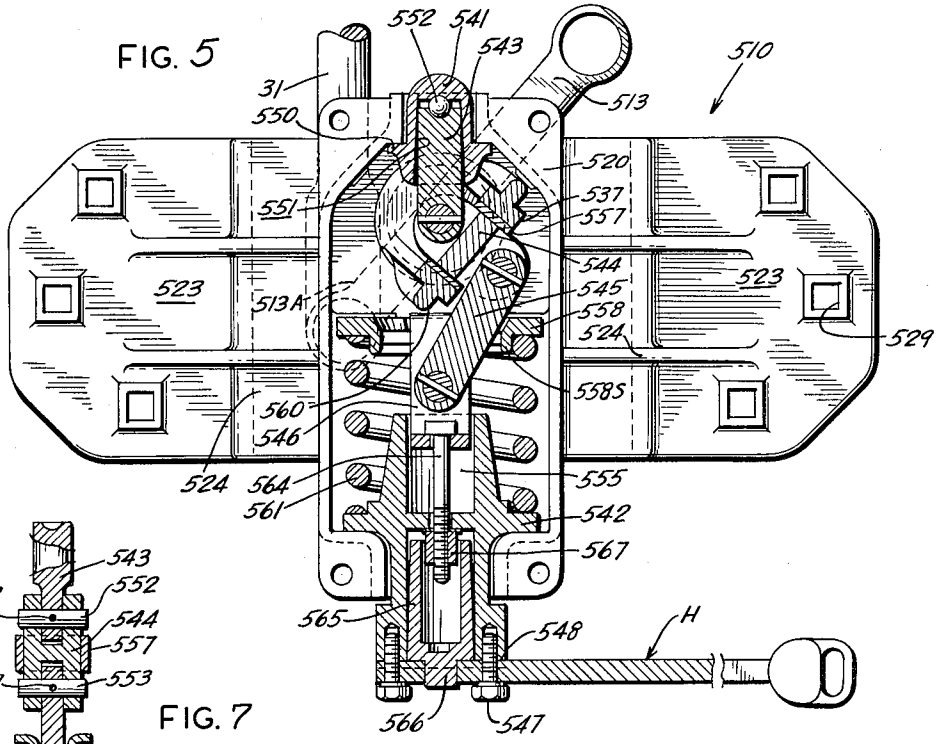


FIG. 7

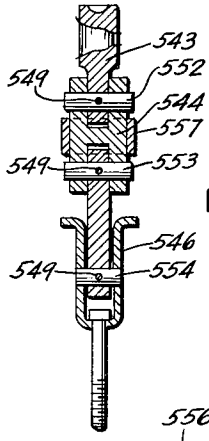
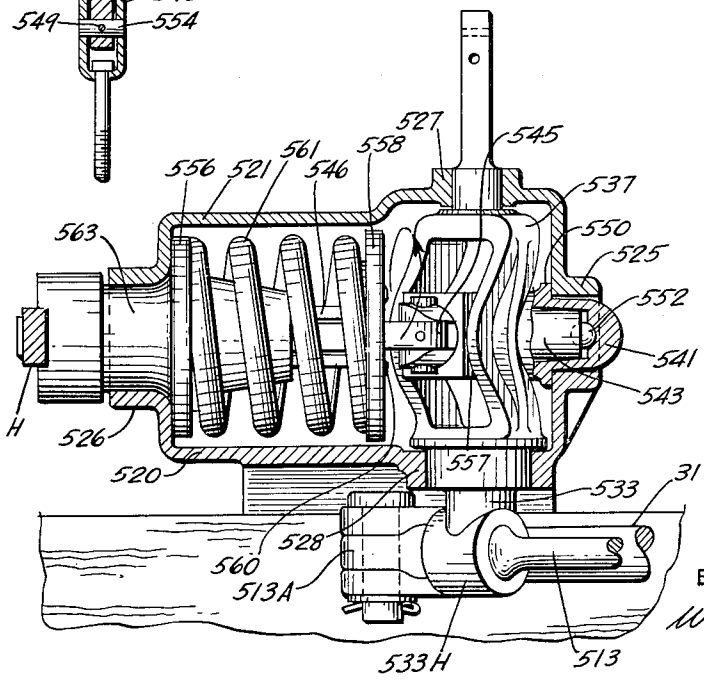


FIG. 6



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RAILROAD SWITCH MECHANISMS

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Filed Feb. 1, 1960, Ser. No. 5,736
1 Claim. (Cl. 246—393)

This invention relates to a railroad switch stand, and in particular to a railroad switch stand that is adapted to be mechanically operated manually or by a locomotive approaching the switch, or automatically by remote control from a control tower.

As is well known in the art, a railroad switch is thrown from one limit position between the stock rails to the other limit position by a throw rod which usually connects the switch points. The conventional mode of operation is one usually accomplished manually by means of a hand lever connected to the throw rod by a mechanical crank linkage or a gear arrangement. It has also been proposed to position the switch automatically in either of its two positions by utilizing air under pressure for driving a piston means which in turn operates gearing connected to the switch point throw rod, but in such systems the need for rather elaborate controls has somewhat retarded general adoption. Moreover, there are times when it is to a disadvantage to have the switch operating solely by way of automatic control.

The primary object of the present invention is to enable a railroad switch to be operated automatically from a remote location, or alternatively to be operated mechanically under any selected circumstance without interference from the mechanism used for automatic operation and without need for introduction of any settable device for changing the conditions of the throw rod from a mode of mechanical to automatic operation or vice-versa.

Specifically, an object of the invention is to remotely throw a railroad switch through the medium of fluid operated piston and cylinder means, the direction of operation of the piston means being determined by the state of an automatically controlled directional valve which determines the flow of fluid under pressure to the cylinder means. The directional valve has a center or intermediate position whereat the piston means is free to move in either direction, that is, is unopposed by any confined fluid, and hence the switch may be thrown manually or, as will be explained, by a locomotive approaching the switch, without interference by the fluid used for automatic or fluid-powdered operation. Additionally, the control for the directional valve is conditioned by the position of the railroad switch, as determined for instance by the limit position of the throw rod, which is to say that when the railroad switch is in one position conditions are already established for throwing the switch automatically to its alternative position when it is desired to reverse the switch. Control is achieved by electrical circuitry including a reversible motor, and conditioning is conveniently attained by use of limit switches included in the circuitry for the reversible motor. Even though the control is conditioned for operation, it is not effective until activated, and hence the directional valve remains in a neutral position enabling the alternative mode of operation for the railroad switch to be used as desired.

In accordance with this invention the directional valve is in the form of a spool valve which is axially movable between two limit positions by pressurized fluid applied to the ends thereof. The spool valve is effective to control the flow of hydraulic fluid both to and from the piston and cylinder means and includes a central portion of reduced diameter. Biasing springs are operatively associated with the ends of the spool valve for returning the

valve to a neutral position intermediate the two limit positions, in which neutral position a path for the free flow of fluid from the cylinder means to a hydraulic reservoir is afforded. Thus, in this neutral position of the valve the fluid operating mechanism offers no resistance to the shifting of the switch points through operation of the switch stand. The reversible motor drives a hydraulic pump which is connected to supply pressurized fluid to a selected end of the spool valve dependent upon the direction of the rotation of the pump. The electrical control circuit thus includes a reversible electric motor connected to drive the pump, manually operable switch means for energizing the motor to rotate the latter in a selected direction, and limit switches, as noted hereinabove, for de-energizing the motor upon shifting of the switch points to a limit position, and the circuit is operatively associated with the fluid pressure operated piston and cylinder means. It is yet another object of this invention to incorporate the foregoing arrangement in a novel mechanism for operating a railroad switch.

Other objects of the persent invention are: to materially simplify the construction of a railroad switch stand arranged for automatic operation by fluid under pressure; to render the control less sensitive whereby the switch stand is rugged and reliable and does not require delicate adjsutment and continuous maintenance; to conserve on power necessary for power or automatic operation of the switch; and to produce a switch stand embodying the foregoing characteristics at an attractive cost.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which, by way of illustration, show a preferred embodiment of the present invention and the principles thereof and what is now considered to be the best mode contemplated for applying these principles. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claim.

In the drawings:

FIG. 1 is a plan view of a railroad switch installation constructed in accordance with one form of the present invention;

FIG. 2 is an elevation view illustrating the manner in which a fluid pressure actuator, as utilized in FIG. 1, may be mounted in the railroad switch installation;

FIG. 3 is a sectional schematic view of a hydraulic power unit utilized in the arrangement illustrated in FIG. 1;

FIG. 4 is a schematic view of an electrical control circuit for controlling the direction of rotation of a hydraulic pump included in the hydraulic power unit as illustrated in FIG. 3;

FIG. 5 is a sectional plan view of the switch stand and its mechanical operating mechanism;

FIG. 6 is a sectional elevation view of the structure shown in FIG. 5; and

FIG. 7 is a sectional view of the links of the crank shaft assembly for the switch stand shown in FIG. 5.

In FIG. 1 of the drawing there is illustrated part of a railroad switch including the two stock rails **20** and **21** which are spiked in the usual fashion to the ties T, and the two movable switch points **23** and **24** which are connected by the usual front and rear throw rods **27** and **28**. As shown in FIG. 1, the railroad switch is conditioned for straight through movement of the locomotive.

The conventional mode of throwing a railroad switch from one of its set or limit positions to the other is by means of a switch stand which includes an operating handle having a crank connection to an arm which in turn is connected to the throw rod of the switch. In this

connection, it will be observed in FIG. 1 that a switch stand 510 is mounted on the ties T outwardly of the left-hand stock rail 20. This switch stand embodies mechanical operating structure to be explained in detail hereinafter in connection with FIGS. 5, 6, 7 of the drawings. It may here be pointed out, however, that the switch stand 510 embodies a throw handle H which is adapted to operate a reciprocal connecting rod 31 in turn connected to the front throw rod 27.

Under the present invention, throwing of the switch points 23 and 24 is in part under control of a fluid operated actuator 35, FIGS. 1 and 2. In the form of the invention illustrated in FIG. 1, the actuator 35 is located on the ties T outward of the right-hand stock rail 21, and includes a pair of cylinders 36 and 37 through an operating rod 38 connected to the end of the throw rod 27 opposite the end which is connected to the rod 31. However, as will be explained, the actuator 35 and its associated fluid operating mechanism can be located adjacent the switch stand 510 with the rod 38 connected to the arm 513 of a double armed crank.

It will be realized from the foregoing that the railroad switch in the present instance is arranged for dual operation, either by the connecting rod 31 which is operated through the switch stand mechanism 510 or by the actuator 35 which is associated with the fluid operated mechanism to be described hereinafter. It is important to point out, however, that the mechanical operating mechanism of the switch stand 510 can be used to augment the action of the actuator 35 in a unique fashion, and moreover, the fluid operating mechanism is so arranged as to enable the railroad switch to be thrown when desired solely by means of the operating handle H or by a locomotive approaching the switch.

The switch stand 510, shown in detail in FIGS. 5 and 6, for the most part is of known construction and is in the nature of that disclosed in U.S. Patent No. 2,575,037 and includes a housing assembled from upper and lower castings 520 and 521. The lower casting is provided with left and right-hand horizontal flanges 523 which are reinforced by vertical gusset plates 524 and which are formed with bolt holes 529 enabling the switch stand to be fastened securely to a pair of railroad ties T as shown in FIG. 1.

The ends of the housing are formed with slevees 525 and 526 serving as bearing mounts for a horizontal crank assembly to be described hereinafter. The upper wall of the housing is provided with a bearing 527 and the lower wall of the housing is provided with a bearing 528, FIG. 6, for receiving and supporting a vertical spindle 533. The spindle 533 is formed at the lower end with a hub 533H, and oppositely directed arms 512 and 513A, FIG. 6, constituting a throw-rod operating lever are connected to the hub 533H. In the form of the invention illustrated in the drawings, the connecting rod 31 which at one end is connected to the throw rod 27, FIG. 1, is in turn connected at its other end to the arm 513A. If it is desired to locate both the switch stand 510 and the actuator 35 on the same side of the railroad switch, rather than on opposite sides as shown in the drawings, then the arm 513 will be the operating arm of the switch stand 510 to be coupled to the operating rod 38.

The horizontal crank shaft assembly which is disposed within the switch stand 510 includes at one end a thrust bushing 541 which is mounted within the sleeve 525 as shown in FIG. 6, and at the other end the crank shaft assembly includes a spring base 542. Arranged between the bushing 541 and the base 542 is an articulated link arrangement including a pivot link 543, an intermediate link or crank pin 544 connected as a toggle unit with a rear link or crank arm 545, and a cross head 546, the latter being part of the crank shaft as will be explained. The hand lever H for manually operating the switch stand is connected to the spring base 542 by bolts 547, the hand lever fitting in a groove 548 at the outer end of the spring base 542.

The thrust bushing 541 is formed with an annular positioning flange 550 which abuts a complemental annular surface at the inner end of the sleeve 525. The bushing 541 is formed with an internal tapered socket 551 which is narrowed in the direction of the outer end of the sleeve 525. A ball 552 is mounted in a recess at the narrow end of the socket 551, and the pivot link 543 is disposed within the socket 551 and is also formed with a recess in which the ball 552 seats. It will be seen from this that the link 543 has both rotative movement and limited pivotal or lateral movement in all directions within bushing 541.

The intermediate link or crank pin 544 is formed with two end recesses so as to be generally H-shaped in section as shown particularly in FIG. 7, and the outer surface of the crank pin 544 is cylindrical so as to be capable of rotation within a spindle block 557 in which it is mounted. The block 557 has a snug sliding fit within a flat-sided opening 559 formed in a spindle box 537, and the spindle box 537 is rigidly joined to the spindle 533.

The rear link 545 is pivoted to the crank pin 544 and is also pivoted to the cross head 546. Such pivoted interconnections are conveniently afforded by pivot pins 552, 553, and 554 as shown in FIG. 7, and locking pins 549 are provided to hold the pivot pins in proper parallel position. The pivot pins are long enough as shown in FIG. 6 to confine the spindle block 557 on the intermediate link 544. The axes of the links 543 and 544 and the pin 552 intersect at a common point located on the axes of the spindle 533 and the crank shaft 542—46. This geometrical relationship is unstable due to play and loose fits as will be explained.

An annular spring cap 558, FIG. 5, is formed with a flange engaged by one end of a coil spring 561, and the cap 558 is formed with a relatively short stub sleeve 558S which is centered in one end of the spring 561. The cap 558 is formed with recesses for receiving positioning and holding lugs 560, FIG. 6, of the cross head 546. The cross head 546 and the coil spring 561 constitute a crank shaft, and the cross head 546 is adapted to slide axially within the bore 555, FIG. 5, of the spring base 542. The bore 555, is rectangular in cross section, and the cross head 546 fits somewhat loosely therein but cloely enough to permit no substantial relative rotation between these parts while permitting relative axial movement. When the cross head 546 slides in the bore 555 toward the operating handle H, the spring 561 is compressed.

The spring 561 also seats on a flange 556, FIG. 6, on the spring base, and the spring base has a reduced hub portion 563 which is loosely journaled in the bearing sleeve 526. An adjusting bolt 564 is passed through openings in the cross head 546 and the spring base 542 as shown in FIG. 5, and a nut 567 on the bolt 564 adjusts the outermost position to which the spring cap 558 can move with respect to the spring base 542. A built-in socket wrench 565 is used for rotating the nut 567, this wrench having a square boss 566 which fits into a complemental square opening in the hand lever H. When the hand lever is bolted to hub 563, wrench 565 and nut 567 are locked thereby in position, and bolt 564 is prevented from turning due to the engagement of its head between the legs of the strap-shaped cross head 546 as will be apparent from FIGS. 6 and 7. When it is desired to adjust nut 567, bolts 547 are removed permitting the hand lever H to be used for turning the wrench 565.

The normal position of the switch stand 510 is illustrated in FIGS. 5 and 6, and it will be noted that the spindle box 537 is in an off-center position defining a stable home state of the railroad switch points, and hence in effect constitutes an actuatable crank arm with the intermediate link 544 constituting a crank pin. Moreover, the rear link 545 constitutes a crank arm while the cross head 546 and the spring base 542 constitute a crank shaft.

Movement of the crank pin 544 due to any rotation of the crank shaft 542—46 causes rotation of the spindle 533 which is affixed to the spindle box 537. Such rotation of the vertical spindle may occur in one of three ways, namely, due to manual throwing of the railroad switch by means of the handle H, or as an incident to operation of the railroad switch through the hydraulic unit described above, or incidental to the camming or wedging action of the wheel flanges of the train approaching the switch points.

Thus, if it is desired to operate the railroad switch manually, the handle H is thrown through 180° from the position shown in FIG. 5. This causes rotation of the spring base 542 as well as rotation of the associated link 546 as a unitary crank shaft. At the same time, link 545 will describe a generally conical path as it is carried from right to left as viewed in FIG. 5 (and as indicated by the arrowed line in FIG. 6); the crank pin 544 will of necessity rotate in the spindle block 557 as it shifts the spindle block from right to left; the link 543 will of necessity rotate and oscillate in the socket 551; and the spindle block 557 turns the spindle box 537, in turn rotating the spindle 533 and arm 513—513A through 90° and imparting reciprocal movement to the connecting rod 531 which is connected to the switch point throw rod.

Now on the other hand, if the switch points of the railroad switch, FIG. 1, are operated with hydraulic power in a manner to be described hereinafter, movement of the railroad switch points to the right as viewed in FIG. 1 will of course be accompanied by movement of the connecting rod 31, and as viewed in FIG. 5 such movement of the connecting rod 31 will correspond to a clockwise rotation of the arms 513 and 513A causing the spindle box 537 to rotate from right to left as viewed in FIG. 5. The spring base 542 is not now under this circumstance being rotated, so rotation of the spindle box 537 simply tends to straighten out toggle links 544 and 545 causing link 546 to move axially in the direction of the handle H. Note that the ball 552 and tapered socket 551 for link 543 are designed to offer little or no resistance to this straightening out tendency, that is, link 543 does not bind or tense. When the links 544 and 545 pass through a dead center position when straightening, their axes will be aligned with the axes of link 543, link 546 and base 542. This dead center position is completely unstable because of the ball 552 and the joining pins, and of course in the meantime spring 561 was undergoing compression. Therefore, as the spindle box rotates through and past dead center position, the spring 561 immediately expands and tends in effect to drive the switch points home thereby assisting the action of the hydraulic piston. The action of the spring 561 under this circumstance, therefore, assures proper home positioning of the switch points, and it is this feature of the present invention which materially simplifies the nature of the control circuit for the hydraulic switch throwing unit.

The operation of the parts in the switch stand 510 due to automatic throwing of the switch points by the train itself approaching the switch points is essentially the same as that described immediately above in connection with what occurs when the connecting rod 31 moves under the influence actuator 35.

The adjusting bolt 564 enables the state of the spring 561 to be determined as of an optimum degree. In other words, the bolt 564 can be adjusted to assure that the switch points are preferably held closed by a slight degree of tension in the spring 561. It will be further noted that the links 543–546 are disposed substantially in a common plane as viewed in FIG. 6 and that the several pivots connecting these links have their axes perpendicular to this plane. Over-centering movements of the links when the spring 561 is being compressed due to automatic operation occurs entirely within this common plane. It will also be observed that the bushing 541, the base 542 and the link 543 have substantial angular play and that the sliding fits of the spring cap 558 in the cross head 546 are loose. Such loose play and fitting increases the instability of the linkage system during automatic operation and assures a high degree of sensitivity of the linkage system at dead center position.

With reference to FIGS. 1 and 2 it is seen that the actuator 35 includes a frame or housing 41. The paired hydraulic cylinders 36 and 37 are affixed to the housing 41 in any suitable manner, and their respective piston rods are pivotally connected to bracket arms 42 and 43 of the operating rod 38. The actuator 35 also includes a hydraulic pump 44 and an electric motor 46 which, as will be explained in greater detail hereinbelow, is adapted to rotate the pump 44 in either of two opposite directions of rotation. Dependent upon the direction of the rotation of the pump 44 within the hydraulic unit housing 41, the pump is connected to supply pressurized hydraulic fluid to one of the cylinders 36 and 37 through respective hose connections 47 and 48. The frame or housing 41 is preferably formed to fit over and between the ties in the manner illustrated in FIGS. 1 and 2 so as not to extend above the top of the railhead. However, this relationship of the height of the actuator 35 to the railhead may be disregarded if the actuator 35 is to be mounted outside of the railroad clearance diagram. While the actuator 35 is illustrated as including two separate cylinders for reciprocating the operating rod 38, it will be recognized from the description to follow that one double-acting hydraulic cylinder could be utilized in place of the paired cylinders illustrated. However, the paired cylinders are preferred inasmuch as such an arrangement enables a more compact actuator assembly to be constructed and also because such paired cylinders effectively eliminate problems of leakage around the portions of the piston rods which project out of the outer casings of the cylinders.

In FIG. 3 there is illustrated in schematic section the component parts of the hydraulic system. The hydraulic pump 44 includes a gear-type pump 49, a reservoir or sump 51, and a spool-type valve 52 which is axially slidable within a bore 53 by fluid pressures developed within chambers 54 and 56 at the opposite ends of the valve. The spool valve 52 is formed with an annular recess 57 which defines a section of reduced diameter at the central portion of the valve. The opposite ends of the spool valve 52 are formed with axially extending bores 58 and 59. Biasing means in the form of coil springs 61 are operatively positioned within the respective bores 58 and 59 for moving the valve 52 to a neutral position whenever the supply of pressurized fluid to the chamber 54 or 56 ceases. In such a neutral position the annulus defined between the annular recesses surface 57 at the central portion of the spool valve and the bore 53 communicates with annular ports 62 and 63 leading to the respective hydraulic cylinders 36 and 37. An annular port 64 and a drain conduit 66 are at all times in communication with the annular chamber defined between the reduced diameter portion of the spool valve and the bore 53 so that in the neutral position of the valve both of the hydraulic cylinders are connected to drain. Thus, the switch points 23 and 24 (see FIG. 1) may be shifted from one limit position to the other, either by the manually operated switch stand 510 or by a railroad car trailing the switch, with no restriction to such movement by the actuator 35.

As noted hereinabove, the spool valve 52 is adapted to be moved axially within the bore 53 by pressurized hydraulic fluid applied to one or the other of the chambers 54 and 56 so as to act on the opposite ends of the spool valves. The pump 49 is reversibly rotatable and is adapted to pump fluid to one or the other of the chambers 54 and 56 by respective first and second conduit means 71 and 72. The first conduit means 71 includes two branch conduits 73 and 74 which respectively lead to the annulus 62 and the chamber 54. A check valve 76 is

disposed within the conduit 73 so as to permit only uni-directional flow from the pump 49 to the annular port 62 and from thence to the hydraulic cylinder 36. At such times as the pump may be rotated in the direction indicated by the arrows X in FIG. 3, a check valve 77 is adapted to be unseated to permit flow from the sump 51 to the inlet side of the pump 49. An excess pressure relief valve 78 is connected to the outlet of the pump 49, with the direction of rotation as indicated by the arrows X, so as to be unseated upon an excess pressure being developed at the outlet of the pump, to vent fluid in excess of such pressure to the sump 51.

The second conduit means 72 also include branch conduits 79 and 81 leading respectively to the annular port 63 and the chamber 56. A uni-directional flow check valve 82 is included in the conduit 79. A check valve 83 permits oil to flow from the sump 51 to the inlet of the pump 49 whenever the pump is rotated in a direction opposite to that indicated by the arrows X in FIG. 3. An excess pressure relief valve 84 is effective to vent an excess fluid pressure within the first conduit means 72 to the sump 51 whenever the pump is rotated in this latter direction of rotation. Restrictive bleeds, from the first and second conduit means 71 and 72 to the sump 51 are included in the hydraulic unit to vent the pressure in these conduit means to drain whenever the pump is not rotated.

In FIG. 4 there is schematically illustrated a control circuit for the electric motor 46, which control circuit is connected to effect rotation of the pump 49 in a desired direction. The control circuit 91 includes a battery B which has one terminal connected to ground, and the motor 46 is connected between the other terminal of the battery and ground. Two pairs of normally open switches A and B are included in the connection between the battery B, the motor and ground. A remote control switch RSA, a solenoid SLA and the limit switch LSA are serially connected with one another and in parallel with both the motor 46 and the two pairs of switches A and B. A holding switch AH is connected in parallel with the manually actuated switch RSA. In like manner a manually actuated switch RSB and a solenoid SLB and the limit switch LSB are serially connected with respect to one another and in parallel with the motor 46 and the pairs of switches A and B. A holding switch BH is connected in parallel with the switch RSB.

It will be noted that the normally open switches A, when closed, enable current to be supplied in one direction through the motor 46, as indicated by the letters Y, while the normally open switches B, when closed, enable current to be supplied through the motor 46 in a direction opposite that obtained whenever the switches A are closed, as indicated by the letters Z. The solenoid SLA, when energized by the closing of the manually control switch RSA, is effective to close both of the switches A and the normally open-holding switch AH. Likewise, the solenoid SLB, when energized by the closing of the manual switch RSB, is effective to close both of the switches B and the normally open-holding switch BH.

Manual operation of the actuator 35 is initiated by closing one of the switches RSA or RSB. Assuming that the switch points are in the poistion illustrated in FIG. 1, and that it is desired to activate the actuator mechanism 35 to move the switch points to the opposite limit position, the normally closed limit switch LSA is maintained in an open postiion by the cam 38R of the operating rod 38. Thus, the limit switch LSB is in its normally closed condition, and the switching operation is initiated by closure of the switch RSB. Such closure of the switch RSB completes a circuit through the solenoid SLB to energize this solenoid and close the normally open switches B and BH. Thereafter the manual switch RSB may be released to an open position, but the solenoid SLA is maintained energized by the holding switch BH. Closure of the switches B is effective to direct current through the

motor 46 in the direction indicated by the arrows Z in FIG. 4 which causes the pump 49 to be rotated in the direction of the arrows X in FIG. 3. Such rotation of the pump causes pressurized hydraulic fluid to be delivered through the first conduit means 71 in the direction indicated by the arrows to shift the spool valve 52 to the leftwardmost limit position illustrated in FIG. 3 and develop a force within the cylinder 36 effective to move the operating rod 38 to the right, as viewed in FIG. 1. Such movement of the operating rod 38 continues until the articulated linkage within the switch stand 510 is moved through the over-center position. Thereafter, the biasing spring within the switch stand 510 exerts an additional force through the rod 31 which adds to the force exerted by the operating rod 38 on the throw rod 27 of the switch. This coaction between the switch stand 510 and the actautor 35 is a quite important feature of this invention inasmuch as such coaction prevents the switch from remaining in an open postiion, simplifies the nature of the control circuit for the hydraulic switch throwing unit, and saves wear and tear on the hydraulic unit.

It should be noted that with the spool valve 52 in the leftwardmost limit position illustrated in FIG. 3, the reduced diameter central portion of the spool valve enables the cylinder 37 to be connected to drain through the conduit 66. Thus, the cylinder 37 cannot restrict movement of the switch points produced by the cylinder 36. Upon movement of the operating rod 38 to the right, as viewed in FIG. 1, the cam 38R is disengaged from the switch LSA, thus enabling the limit switch LSA to return to its normally closed condition. Prior to the switch points 23 and 24 arriving at the limit position opposite to that illustrated in FIG. 1, the cam 38R contacts the switch LSB to open this switch and thus de-energize the solenoid SLB and the motor 46. The exact position of the limit switches on the housing is not critical. It is necessary only that a respective one of these switches be maintanied in its normally closed position until the operating rod 38 is moved to a position corresponding to an over-center condition of the articulated linkage within the switch stand 510, since the biasing spring thereafter assures that the switch points 23 and 24 will be moved to the selected limit position. The manner in which the limit switches are associated with the movement of the operating rod 38 enables the actuator to be conditioned to throw the switch points in one direction while the movement of the switch points in the opposite direction is being accomplished. Thus, movement of the operating rod 38 to the right, as viewed in FIG. 1, first closes switch LSA and then opens switch LSB, thereby conditioning the actuator for returning the switch points 23 and 24 to the position illustrated in FIG. 1 whenever the switch RSA is closed.

It will be seen from the foregoing that I am able to throw a railroad switch by a fluid force applied by a piston while at the same time allowing for throwing of the switch by a mechanically applied force, and this in part capable of achievement as a result of the way in which the directional valve is constructed and arranged to be shifted by the reversible pump and electrical control mechanism in the fluid-operating means. Additionally, the means for throwing the switch by a mechanically applied force embodies a helical spring and a toggle linkage so connected thereto that when the switch is thrown by a fluid force the toggle is straightened, applying a compressing force to the spring about midway of the switch point throwing distance, and as the switch point is moved through the remainder of its distance, the toggle passes through and beyond its dead center (or over-center) position whereupon pressure on the spring is released and the spring expands to assist or aid the piston in the fluid means which is moving the switch point. Hence, while I have illustrated and described a preferred embodiment of my invention, it is to be understood that this is capable of variation and modification,

and I therefore do not wish to be limited to the precise details set forth, but desire to avail myself of such changes and alterations as fall within the purview of the following claim.

I claim:

Apparatus of the kind described for shifting the shift points of a railroad switch between two limit positions and comprising; a switch stand including manually operable over-center linkage means for shifting the switch points between the two limit positions and exerting a biasing force for maintaining the switch points in each of the limit positions, a pair of hydraulic cylinders, a control rod connected to said cylinders so as to be reciprocable by said cylinders and connected to switch stand so as to be reciprocal by said switch stand, a reversible hydraulic pump for supplying pressurized fluid to said cylinders, a spool valve axially movable to limit positions by pressurized fluid applied to the ends thereof in which limit positions the spool valve is effective to supply pressurized fluid to one of said cylinders while connecting the other of said cylinders to drain, first conduit means for supplying pressurized hydraulic fluid from the pump to both one end of the spool valve and one of said cylinders whenever the pump is rotated in a first direction, second conduit means for supplying pressurized hydraulic fluid from the pump to both the other end of the valve and the other of said cylinders whenever the pump is rotated in a second direction opposite said first direction, said valve having a reduced diameter center portion for connecting both of said cylinders to drain in a neutral position of the valve, biasing means for returning the valve to a neutral position whenever

said pump is not being rotated in either of said first or second directions, said spool valve offering no restriction to the shifting of said switch points by said switch stand, when said spool valve is in the neutral position and control means including, a reversible electric motor for rotating said pump in either of said directions, manually operable switch means for selectively energizing the motor to rotate in a predetermined direction, cam means on said control rod, and a pair of spaced limit switch means, each of said limit switch means actuated by said control rod cam means for de-energizing said motor whenever said rod is moved to a position corresponding to a limit position of said switch points by said motor, said control rod being movable by said switch stand to move said cam means to actuate said limit switch means to condition said electric motor for rotation to shift said switch points in a direction opposite to that shifted by said switch stand.

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