March 5, 1935. J. H. STALEY 1,993,533

SYSTEM FOR OPERATING CROSSING GATES

Filed June 29, 1933 2 Sheets-Sheet 1

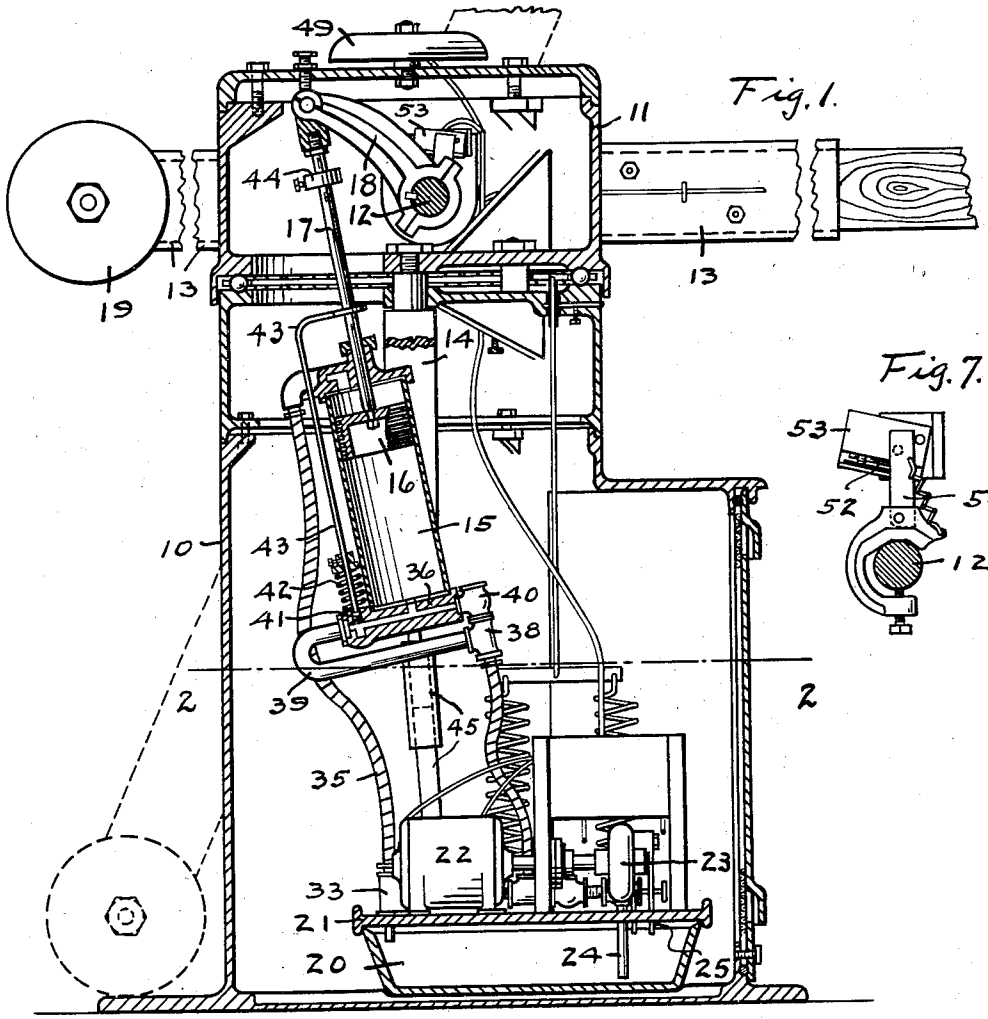


Fig. 1.

Fig. 7.

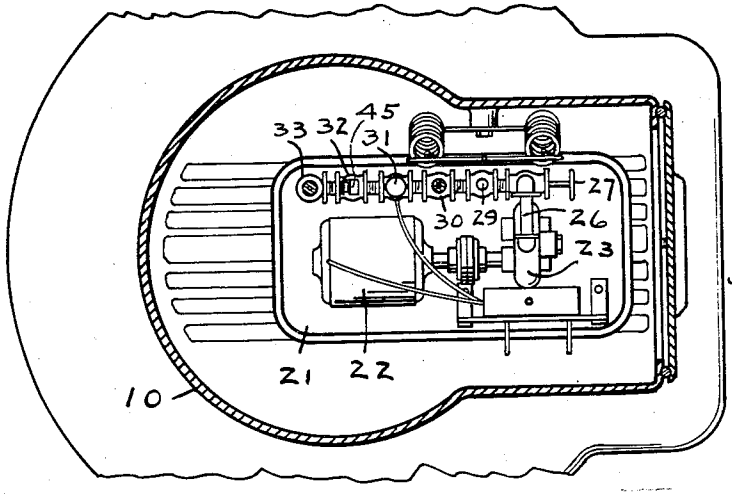


Fig. 2.

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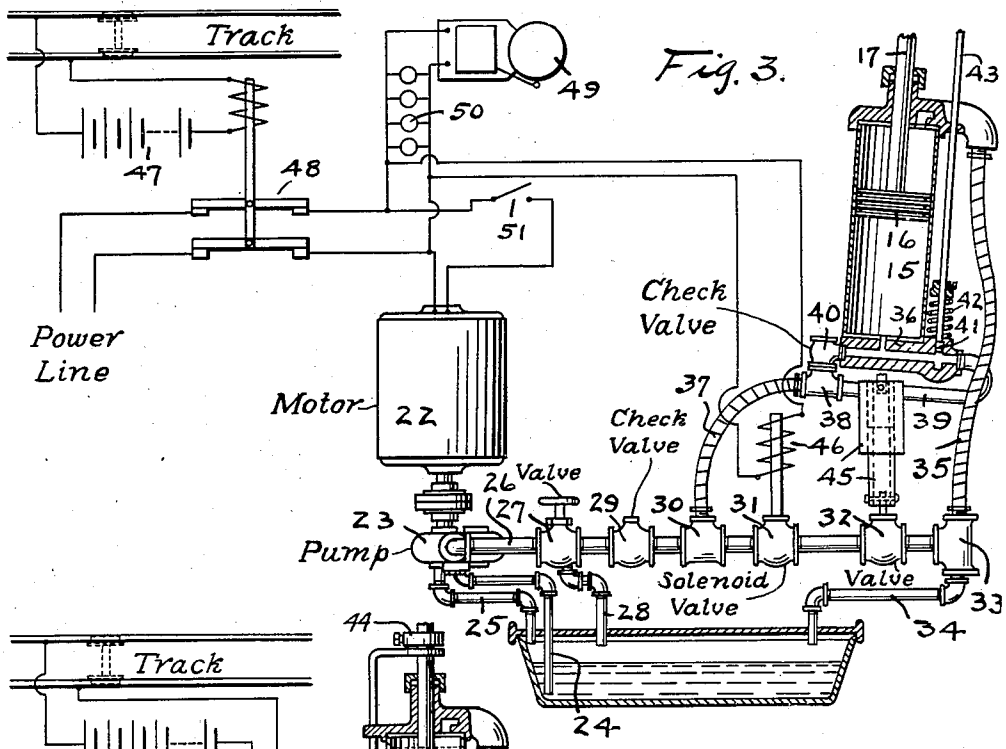


Fig. 3.

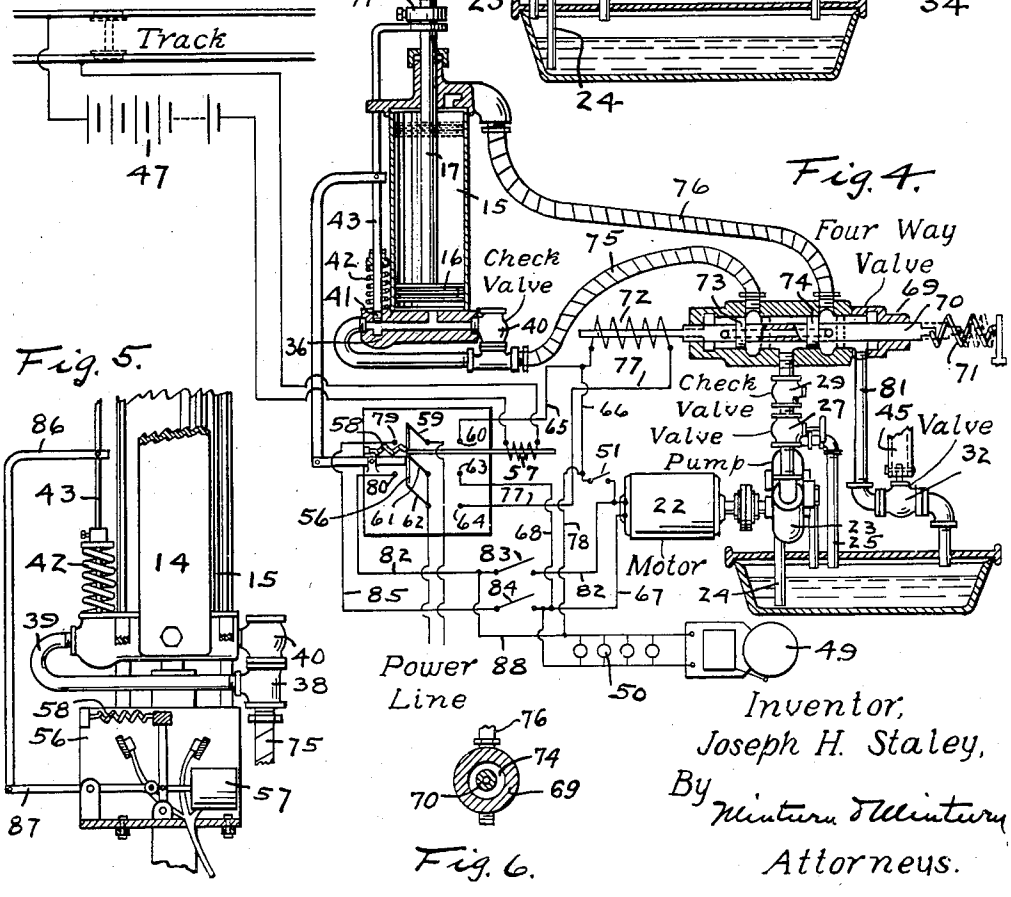


Fig. 4.

Fig. 5.

Fig. 6.

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UNITED STATES PATENT OFFICE

1,993,533

SYSTEM FOR OPERATING CROSSING GATES

Joseph H. Staley, Columbus, Ind.

Application June 29, 1933, Serial No. 678,238

12 Claims. (Cl. 39—7)

This invention relates to the art of crossing gates and particularly to means for controlling the operation of such gates. Reference is made to my copending application filed in the United States Patent Office November 29, 1932, Serial No. 644,839, which shows one particular form of a gate to which my present invention may be applied. My present invention has several advantages including the forming of a control unit which may be assembled in a removable manner as a unit over an oil pan whereby the unit may be readily placed within a gate standard and removed therefrom for inspection and repair as the case may be. Another advantage is to be found that in the use of my invention there is no leakage of oil from the operating cylinder and no packing is required on the operating piston. A still further advantage of the invention is that the operation of the gate is cushioning, particularly in that method of opening a gate by overbalancing weights so that the structure may be relieved of sudden impacts.

My invention is adapted to be applied to that type of a gate which has a head on which the gate arm is mounted to swing vertically and which head is adapted to be revolved horizontally so that should the gate be struck by a vehicle when in the lower or closed position, the gate arm may be turned around without being broken. It often happens that a gate will be installed at a crossing where overhead wires are present and in order to avoid the raising of the gate arm when in the revolved position to cause the arm to interfere with such wires, my invention provides a control means preventing the operation of the gate lifting mechanism while the gate is in the revolved position.

Other advantages are found in the particular association of the various elements as set forth in the accompanying claims which promote great reliability of the structure under all operating conditions and which permit the building thereof at a relatively low cost of production and installation.

These and other objects and advantages will become apparent to those skilled in the art in the following description of the invention as illustrated by the accompanying drawings, in which

Fig. 1 is a fragmentary central vertical section through a gate structure to which my invention is applied;

Fig. 2, a transverse horizontal section on the line 2—2 in Fig. 1;

Fig. 3, a combined schematic and wiring diagram of the operating and control mechanism;

Fig. 4, a similar diagram but showing a system for applying power to both sides of the actuating piston;

Fig. 5, a detail in fragmentary vertical section of the main control switch and the system indicated in Fig. 4;

Fig. 6, a transverse vertical section through the four-way valve as employed in the system indicated in Fig. 4; and

Fig. 7, a detail in side elevation of an auxiliary control switch.

Like characters of reference indicate like parts throughout the several views in the drawings.

Referring first to the gate structure itself, one particular form of such a structure to which my invention may be applied is indicated in Figs. 1 and 2 and more fully shown in my copending application above referred to. In this structure, is a hollow standard 10 on which a revolving head 11 is mounted. A transverse shaft 12 is rotatably carried by the head 11 and has a gate arm 13 fixed thereto to revolve therewith. A cylinder carrying member 14 is fixed to the head 11 to be revolved therewith and an operating cylinder 15 is carried by this member 14 to have a piston 16 within the cylinder 15 and a piston rod 17 extending through the upper end of the cylinder and rockably connected to the arm 18 which is fixed on the shaft 12, whereby reciprocation of the piston 16 in the cylinder 15 will correspondingly rock the arm 18 and thereby rock the gate arm 13 accordingly. In a common type of gate, the arm 13 extends back of the shaft 12 for a distance and has a weight 19 fixed thereto normally overbalancing the arm extending to the other side of the shaft 12 whereby the weight 19 will normally swing the gate arm 13 around to an open or upper position as indicated by the dash lines in Fig. 1. In so doing the weight 19 will tend to return the piston 16 to the lower end of the cylinder 15. It is to be noted that the upper end of the cylinder 15 has a head through which the piston rod 17 slides with a fit to prevent oil leaking therepast.

In further reference to the gate structure, the head 11 is normally retained in a position to permit the arm 13 to swing across the roadway being guarded but may yieldingly be rotated.

Referring now to the means for actuating and controlling the movement of the piston 16, I provide an oil pan 20 preferably of a shallow nature and of small capacity, one particular size being adapted to have a volume slightly in excess of a gallon. Within this pan I place a quantity of oil,

a gallon being sufficient in most cases, and over the pan I place a cover 21 loosely resting thereon. Preferably the floor within the standard 10 is made to have a locating depression which will just receive the base of the pan 20 and retain it in that location.

A motor 22 is mounted on the cover 21 and is directly coupled to a pump 23 likewise mounted on the cover. This pump 23 has an intake pipe 24 extending down through the cover 21 well toward the bottom of the pan 20. This pump is also built to have a relief valve incorporated within it whereby the delivery from the pump cannot exceed a predetermined pressure and in this regard a return pipe 25 leads from such a valve back through the cover 21 to discharge into the pan 20. The structure of the pump is not herein set out in detail since it may be obtained in a commercial form and its details do not enter into my invention. The pump has a discharge pipe 26 leading to a throttle valve 27. This valve may be of the usual type to control the flow of oil discharged from the pump but in order to relieve the pump of excessive work, so that pressures below the maximum permitted by its relief valve may be had, the valve 27 may be of a by-pass type wherein a part of the oil is returned through the pipe 28 through the cover 21 into the pan 20. From the valve 27 the discharge line continues through a check valve 29 so arranged as to permit the oil to flow from the throttle valve through the check valve but not in the reversed direction.

In the form of the invention as shown in Figs. 1–3, the discharge line continues from the check valve 29 to include an outlet T 30, then a shut off valve 31 operated by a solenoid, a second shut off valve 32 and finally a T 33 from one end of which a line 34 leads back through the cover 21 to discharge into the pan 20 and from the other end of which a flexible pipe or hose 35 leads to the upper head of the cylinder 15 to receive oil discharge through a passageway formed in this head leading from within the cylinder 15.

The lower end of the cylinder 15 is provided with a head 36 here shown as having a bore transversely therethrough from which a passageway leads into the cylinder 15. A flexible pipe or hose 37 leads from the T 30 to the T 38 from which a pipe 39 leads one way around to one end of the bore in the head 36, the other outlet of the T being connected with a check valve 40 interposed between the T and the other end of the bore in the head 36. The check valve 40 is placed so as to permit flow from the pipe 37 through the T 38, the valve 40, into the bore of the head, but not in the reverse direction. Intercepting that end of the bore in the head 36 adjacent the connection therewith of the pipe 39 is a valve 41 normally held open by a spring 42. This valve 41 has a rod 43 extending upwardly and thence around adjacent the piston rod 16 to have an end in the path of a collar 44 which is adjustably carried on the piston rod 17 so that the collar 44 may be suitably located along the rod 17 to strike the end of the rod 43 when the piston 16 approaches its lower end of travel and thereby overcome the spring 42 to lower the valve 41 so as to intercept the bore through the head 36 and thereby prevent discharge from the cylinder 15 into the pipe 39, the check valve 40 permitting flow out of the other end of the bore.

Between the shut off valve 32 and the member 14 which supports the cylinder 15 is a connecting member of such a nature that upon rotation of the member 14, this connecting member 45 will correspondingly turn the shiftable member in the valve, the valve normally being open and only closed upon rotation of the head 11 from its normal position. The solenoid valve 31 is normally open and is only closed when the winding 46 of its coil is energized. Referring now principally to Fig. 3, the gate operation is automatically controlled by the closing and opening of a circuit in a track block. In Fig. 3, it is indicated that the track circuit is closed and that some source of power, here indicated as a battery 47 has been included in the track circuit to energize and cause a relay switch 48, here shown as being double pole, to close a circuit from a power line. When this switch 48 is closed, a circuit is completed through the pump operating motor 22; a circuit is also closed including the solenoid winding 46 so as to close the valve 31, and an alarm circuit is closed to include a bell 49, here shown, Fig. 1, as being mounted on the top of the head 11, and one or more lamps 50, such lamps being placed to be visible upon approaching the gate along the roadway to be closed by the gate. Preferably such lamps 50 are included or mounted on the arm 13 so as to be carried by the arm out over the roadway. Reference to Fig. 3 will show a switch 51 included in the circuit of the relay switch 48 and the motor 22. This switch 51 is mounted preferably in the head 11 and is normally closed when the gate arm 13 is in the upper or open position. One particular form of the switch 51 is that of a mercury tube switch which may be operated merely by tilting the tube from one position to another. The mounting of this switch is indicated in Fig. 7, wherein a mercury switch tube 52 is mounted in a carrier 53 to be rocked by an arm 54 carried by the clamp 55 on the shaft 12. The arm 54 is adjustably located about the shaft 12 so as to rock the carrier 53 to tilt the tube 52 to the "off" or open circuit position when the gate 13 reaches the lowered or closed position. As above indicated this switch 51 is normally closed so that when the switch 48 closes, the motor 22 is at once set in operation and oil pumped from the pan 20 and delivered under pressure through the valve 27, check valve 29, hose 37, and pipe 39 or valve 40 through the head 36 into the cylinder 15 under the piston 16. The oil thus flowing into the cylinder 15 forces the piston 16 upwardly therein and the rate of travel is controlled by the adjustment of the valve 27. The piston 16 is not provided with any packing but is merely fitted to slide within the cylinder 15 with a fairly close fit and has a number of grooves therearound retarding the seepage of oil past the piston. What oil does leak past the piston 16 may discharge through the upper head and return through the pipes 35 and 34 into the pan 20 so that there is no loss of oil by leakage.

When the piston 16 reaches the position wherein the gate arm 13 has been lowered to substantially a horizontal position, the switch 51 is then operated by the arm 54 rocking the tube 52 and the motor 22 is then stopped but the coil 46 controlling the valve 31 remains energized and the check valve 29 prevents return flow of the oil from the cylinder 15. Of course should there be some leakage back through either the check valve 29 or the solenoid valve 31, the pressure in the cylinder 15 under the piston 16 would be reduced, and if the reduction is sufficient, the weight 19 will tend to lift the gate arm 13, but a slight travel upward of the arm 13 will close

the switch 51 to cause the motor 22 to restore the pressure in the cylinder 15.

Now when the track circuit is open, the relay switch 48 then opens causing the coil 46 of the solenoid valve to become deenergized. Following the action, the valve 31 opens and permits oil to drain back from the cylinder 15 through the pipe 39 and hose 37, valve 31, valve 32, T. 33, and the pipe 34 into the pin 20. This draining is further accelerated by the weight 19 tending to push the piston 16 down into the cylinder to force out the oil. Near the end of the lower travel of the piston 16, the collar 44 will strike the end of the rod 43 and close the valve 41 thereby shutting off further flow of the oil from the cylinder 15 so that a small volume of oil is left within the cylinder to serve as a cushion to decelerate the travel of the piston and consequently of the weight 19 finally bringing the weight to rest without undue impact against the base of the standard. Thus it is to be seen that when the gate arm 13 is in the normal open position, the valve 41 remains closed. In the subsequent operation of closing the gate, oil is first delivered into the cylinder from the pipe 37 through the check valve 40 until the valve 41 is opened to permit oil to flow also through the pipe 39. In other words, upon the initial movement of the piston 16 in its upward stroke, the oil is first supplied through the check valve 40 and thence in increasing manner through the pipe 39.

Should the gate arm 13 be revolved around horizontally when in the closed position, the valve 32 will be closed accordingly. Under this condition, should the track circuit then be broken, and the coil 46 deenergized, although the valve 31 is then opened, return flow of oil from the cylinder 15 is prevented by reason of the valve 32 then being closed and therefore the gate cannot lift until it is returned to its normal position across the roadway so as to open the valve 32.

In the foregoing description, reference has been made to that type of gate wherein the piston has power applied to one side thereof only to close the gate and the gate is opened by an overbalancing weight. In Figs. 4–6 is shown a system for employing power independently of weight means for both lowering the gate and for raising it, a weight in this case being employed only for the purpose of counterbalancing the weight of the arm, if employed at all. In this system, a track circuit is employed to include the usual battery 47 but instead of the relay switch 48, a relay switch 56 of a three pole, double throw type is operated by this circuit. Reference to Fig. 4 is made wherein this switch 56 has an operating coil 57 adapted to be energized upon the closing of the track circuit whereby the switch is thrown against the pull of a spring 58 to a closed position whereby one of the knives 59 of the switch closes the circuit between one side of a power line and the pole 60 and the other two knives 61 and 62, both being hooked together, close a circuit from the other side of the power line with the poles 63 and 64 respectively. This operation closes a circuit in the power line from the pole 60 through the wire 65, wire 66, switch 51 (normally closed), motor 22, wire 67, and wire 68 back to the pole 63 of the switch 56. The closing of this particular circuit causes the motor 22 to be set in motion to actuate the pump 23 as before whereby oil is delivered from the pan 20 through the throttle valve 27, check valve 29 and to within the body of a four-way valve 69.

This valve 69 is provided with a slide member 70 adapted to be held at one end of travel against the pull of a spring 71 by energizing the coil 72 of a solenoid magnet and to be returned to its other end of travel by the spring 71 upon the deenergizing of the coil 72. This slide 70 is a cylinder member having its major portion of less diameter than that of the bore within which it slides through the body of the valve and has two spaced apart enlargements 73 and 74 fitted to be in sliding contact with the wall of the bore. The slide 70 has a hollow bore extending to beyond the enlargements 73 and 74 with openings therefrom at each end. The discharge from the check valve 29 into the valve body 69 is always between the two enlargements 73 and 74 of the slide and upon suitable shifting of the slide 70 this discharge may be discharged from the body 69 into either the flexible pipe 75 or the flexible pipe 76 which lead from spaced apart ports in the body 69.

When the switch 56 is closed as above indicated, a circuit is closed from the power line through the poles 60, wires 65, coil 72, wire 77, and the pole 64 then connected with the other side of the power line. The coil 72 thus being energized causes the slide 70 to be shifted against the pull of the spring 71 to cause both enlargements on the slide to be shifted so that the enlargement 74 closes off communication between the discharge of the check valve 29 and the hose 76 but permits discharge into the hose 75 as indicated in the solid line position, Fig. 4. The hose 75 is connected to discharge through either the check valve 40 or the pipe line 39 depending upon the position of the valve 41 which is controlled in the same manner as above indicated. Thus with the circuits closed, as indicated, the piston 16 is carried upwardly within the cylinder 15 to close the gate. The switch 51 is opened upon the closing of the gate in the same manner as above indicated so as to open the motor circuit while the circuit through the coil 72 remains closed. The bell 49 and lamps 50 are included in a circuit between the wire 66, wire 78 and the wires 67, 68, so that the alarm signals may operate irrespective of the switch 51. Of course should the pressure for any reason be lowered under the piston 16, the gate will rise sufficiently to close the switch 51 whereupon the motor 22 will again operate to restore the pressure.

Now when the track circuit is opened and the coil 57 is deenergized, the spring 58 will throw the switch 56 to the opposite side whereupon the knives 59 and 61 will be brought into contact respectively with the poles 79 and 80, no pole being provided for the knife 62. When in this position, the circuit is broken which formerly included the coil 72 so that the slide 70 is pulled to its other end of travel by the spring 71 as indicated by the dotted lines whereupon the enlargement 73 is carried to the right of the port leading to the hose 75 and the enlargement 74 to the right of the port leading to the hose 76. In this position of the slide 70, with the piston 16 at its upper end of travel, oil may drain from the cylinder 15 through the pipe 39 (the valve 41 being open) back through the pipe 75 and to within the valve body 76 to the left of the enlargement 73 to flow into the bore through the slide and discharge therefrom to the right of the enlargement 74 to flow from the body out through the return pipe 81, through the valve 32 and back through the cover 21 into the pan 20. Since there is no weight tending to lift the gate, this return flow will not be affected by travel of the piston 16

until power is applied on the upper side of the piston 16. However, with the switch 56 thrown to the position as last described, a circuit is closed from the power line through the wires 82, switch 83, motor 22, wire 67, switch 84, and wire 85. The switches 83 and 84 are both preferably of the mercury tube type and are mounted alongside of the tube 52 in the carrier 53, but are mounted in the reverse manner so that when the gate is closed, the switches 83 and 84 are likewise in the "closed" positions whereas switch 51 is in the open position. The switches 83 and 84 are rocked to their open positions when the gate itself is lifted to the open position. Therefore, when the switch 56 has been thrown to the position last indicated, these switches 83 and 84 are closed and the motor 22 is set in operation to supply pressure to within the valve body 69 to between the two enlargements 73 and 74 on the slide 70, the slide then being in that position whereby this oil supplied is cut off from flow into the pipe 75 but may flow into the pipe 76 which is connected to the upper head of the cylinder 15 to discharge through the head into the cylinder 15 above the piston 16. Thus oil is supplied under pressure through the valve 69 against the top face of the piston 16 to force it downwardly and thereby rock the gate upwardly to its open position.

The switch 56 being held in a closed position by the spring 58 must be opened so as to break the circuit between the power line of the motor 22 and also be shifted so as to be ready to be thrown to the opposite side again when the track circuit is closed to energize the coil 57. I accomplish this action by supplying an arm 86 attached to the rod 43 by one end and by the other end to a lever 87 which is rockably supported on the switch base to have its other end carried against the center knife 61 in such a manner that upon rocking the lever 87 through downward travel of the rod 43, the end of the lever 87 adjacent the switch knife is lifted so as to push the knives out of engagement with the poles 79 and 80 and carry the knives to positions midway between these poles and the poles on the other side. This shifting of the switch 56 from the poles 79 and 80 is accomplished only as the piston 16 approaches its lower end of travel and simultaneously with the passage of the valve 41 across the bore in the lower head 36 cutting off the return flow of oil. By supplying a wire 88 between the wire 82 and the wire 78, the signals 49 and 50 are maintained in the circuit with the power line as long as the switch 56 is in the closed position with the poles 79 and 80 irrespective of the positions of the switches 83 and 84.

The valve 32 is provided to intercept the return flow of the oil as in the other form so that drainage cannot be effected unless the gate arm is in its proper position in reference to horizontal travel.

While I have herein shown and described my invention in the particular forms as now best known to me, it is obvious that changes may be made in the structure thereof without departing from the spirit of the invention and I therefore do not desire to be limited to those precise forms beyond the limitations as may be imposed by the following claims.

I claim:

1. For a crossing gate having a standard, a gate arm rockably carried by the standard, a cylinder, a piston in the cylinder, a piston rod interconnected with the gate, and an initiating circuit including a source of electrical current, an operating system including a fluid tank, a pump adapted to take fluid from the tank, a pump operating motor, a switch normally open and adapted to close a circuit from a power line to include said motor upon the closing of said first circuit, a discharge line leading from the pump to said cylinder, a throttling valve in the line, a check valve in the line after the throttling valve, a tank return line interconnected with the discharge line and leading back to said tank, an electrically controlled valve between the discharge and return lines, said last valve being open when its operating coil is deenergized and its operating coil being included in said second circuit, and a second switch in said second circuit normally closed and opened by travel of said gate arm upon reaching its closed position, said second switch being arranged in said second circuit to interrupt flow of current to said motor without affecting flow to said coil.

2. For a crossing gate control system, in combination with a gate rockably carried by a standard, a cylinder, a piston in the cylinder operatively connected with the gate, an oil supply tank, a pump having an intake line from the tank and a discharge line leading to said cylinder, a switch normally closed and formed to be opened by travel of the gate as the gate approaches its closed position, a motor operatively connected with said pump and controlled by said switch, a cylinder drain line discharging to said tank, an electrically operated valve normally open in said drain line between the tank and the cylinder, and an electrical circuit including a main switch for controlling a flow of current from a power line through said first switch to said motor and also through an operating coil associated with said valve.

3. For a crossing gate control system, in combination with a gate rockably carried by a standard, a cylinder, a piston in the cylinder operatively connected with the gate, an oil supply tank, a pump having an intake line from the tank and a discharge line leading to said cylinder, a switch normally closed and formed to be opened by travel of the gate as the gate approaches its closed position, a motor operatively connected with said pump and controlled by said switch, a cylinder drain line discharging to said tank, an electrically operated valve normally open in said drain line between the tank and the cylinder, and an electrical circuit including a main switch for controlling a flow of current from a power line through said first switch to said motor and also through an operating coil associated with said valve, said gate being mounted to revolve horizontally as well as to swing vertically, a cut-off valve normally open in said drain line between the tank and the electrically controlled valve, and cut-off valve operating means interposed between said valve and the gate whereby horizontal travel of the gate will actuate the cut-off valve.

4. For a crossing gate control system, in combination with a gate rockably carried by a standard, a cylinder, a piston in the cylinder operatively connected with the gate, an oil supply tank, a pump having an intake line from the tank and a discharge line leading to said cylinder, a switch normally closed and formed to be opened by travel of the gate as the gate approaches its closed position, a motor operatively connected with said pump and controlled by said switch, a cylinder drain line discharging to said tank, an electrically operated valve normally open in said

drain line between the tank and the cylinder, and an electrical circuit including a main switch for controlling a flow of current from a power line through said first switch to said motor and also through an operating coil associated with said valve, said electrically operated valve comprising a four way valve interconnecting with said pump discharge line, and said discharge line two branches between the valve and the cylinder, one branch leading from the valve to one end of the cylinder and the other part leading from the valve to the other end of the cylinder whereby a passage may be selectively provided through the valve from the pump to either end of the cylinder.

5. For a crossing gate control system, in combination with a gate rockably carried by a standard, a cylinder, a piston in the cylinder operatively connected with the gate, an oil supply tank, a pump having an intake line from the tank and a discharge line leading to said cylinder, a switch normally closed and formed to be opened by travel of the gate as the gate approaches its closed position, a motor operatively connected with said pump and controlled by said switch, a cylinder drain line discharging to said tank, an electrically operated valve normally open in said drain line between the tank and the cylinder, and an electrical circuit including a main switch for controlling a flow of current from a power line through said first switch to said motor and also through an operating coil associated with said valve, said electrically operated valve comprising a four way valve interconnecting with said pump discharge line, and said discharge line two branches between the valve and the cylinder, one branch leading from the valve to one end of the cylinder and the other part leading from the valve to the other end of the cylinder whereby a passage may be selectively provided through the valve from the pump to either end of the cylinder, and a third switch in said circuit normally closed to be opened by travel of the gate toward the limit of its open position to thereby interrupt flow of current to said motor.

6. For a crossing gate control system, in combination with a gate rockably carried by a standard, a cylinder, a piston in the cylinder operatively connected with the gate, an oil supply tank, a pump having an intake line from the tank and a discharge line leading to said cylinder, a switch normally closed and formed to be opened by travel of the gate as the gate approaches its closed position, a motor operatively connected with said pump and controlled by said switch, a cylinder drain line discharging to said tank, an electrically operated valve normally open in said drain line between the tank and the cylinder, and an electrical circuit including a main switch for controlling a flow of current from a power line through said first switch to said motor and also through an operating coil associated with said valve, said electrically operated valve comprising a four way valve interconnecting with said pump discharge line, and said discharge line having two branches between the valve and the cylinder, one branch leading from the valve to one end of the cylinder and the other part leading from the valve to the other end of the cylinder whereby a passage may be selectively provided through the valve from the pump to either end of the cylinder, and a third switch in said circuit normally closed to be opened by travel of the gate toward the limit of its open position to thereby interrupt flow of current to said motor, said main switch comprising a double throw switch, means interposed between said piston and switch for returning the switch to an open position upon travel of the piston substantially to its limit at the open position of said gate, electromagnetic means for closing said main switch in one direction to provide for a flow of current to said motor independently of said third switch, and spring means tending to close the main switch in an opposite direction when said electromagnetic means is inoperative to provide for flow of current through said third switch.

7. In a crossing gate control system, a cylinder, an operating piston in the cylinder, a pump, a fluid supply line from the pump to the cylinder, a motor for operating the pump, an electrical circuit including the motor, a limit switch in the circuit actuated by travel of the piston to open the circuit, an electro-magnetically operated main switch in the circuit, an initiating circuit for actuating the main switch, a third switch in said first circuit actuated by travel of said piston to open said circuit at the end of travel of the piston opposite to that when said limit switch is opened, said main switch being closed by energization of the initiating circuit to supply current through said limit switch, a spring closing the main switch in another direction to supply current through said third switch and means actuated by said piston for placing the main switch in an open position.

8. In a crossing gate control system, a cylinder, a piston in the cylinder for operating a gate, a pump for supplying fluid to the cylinder, a motor, an electrical circuit including the motor, a gate closing limit switch interrupting the circuit upon travel of the piston to a closed gate position, a gate opening limit switch interrupting said circuit upon travel of the piston to an open gate position, and a main switch in the circuit, said circuit and said switches being arranged to have the circuit completed through the main switch and said motor when the open limit switch is open, and when the main switch is in a shifted position to complete the circuit through it and the motor when the closed limit switch is open.

9. For a crossing gate having a cylinder and an actuating piston, an operating system comprising a fluid pump interconnected with the cylinder, a motor driving the pump, a valve between the pump and cylinder adapted to be shifted to direct fluid selectively to either end of the cylinder, electromagnetic means for shifting the valve, a power circuit including said motor and said electro-magnetic means, a main switch in the circuit, an auxiliary switch cutting the motor in and out of said circuit upon predetermined gate travel in one direction, a second auxiliary switch cutting the motor in and out of said circuit upon predetermined travel in a reverse direction, means for opening said main switch actuated by travel of said piston toward one end thereof, a second circuit, and electro-magnetic means in the second circuit for closing said main switch upon closure of the second circuit.

10. For a crossing gate having a cylinder and an actuating piston, an operating system comprising a fluid pump interconnected with the cylinder, a motor driving the pump, a valve between the pump and cylinder adapted to be shifted to direct fluid selectively to either end of the cylinder, electro-magnetic means for shifting the valve, a power circuit including said motor and said electro-magnetic means, a main switch in

the circuit, an auxiliary switch cutting the motor in and out of said circuit upon predetermined gate travel in one direction, a second auxiliary switch cutting the motor in and out of said circuit upon predetermined travel in a reverse direction, means for opening said main switch actuated by travel of said piston toward one end thereof, a second circuit, and electro-magnetic means in the second circuit for closing said main switch upon closure of the second circuit, said first circuit being in two branches each including said motor but one branch only including both the motor and said valve electro-magnetic means, said main switch being adapted to close selectively either of said branches, means for biasing said main switch to close that branch including said motor only, and means for biasing said valve to a position permitting fluid flow to produce an open gate position.

11. For a crossing gate having a cylinder and a double acting piston, means for supplying fluid under pressure to the cylinder, and a valve selectively admitting and draining said fluid to and from either side of the piston, an operating system therefor comprising means for shifting the valve, means arresting said fluid supply means upon a predetermined gate travel to an open position, means arresting said supply means upon a predetermined gate travel to a closed position, and means for initiating actuation of said supply means independently of said open position arresting means.

12. For a crossing gate having a cylinder and a double acting piston, means for supplying fluid under pressure to the cylinder, and a valve selectively admitting and draining said fluid to and from either side of the piston, an operating system therefor comprising means for shifting the valve, means arresting said fluid supply means upon a predetermined gate travel to an open position, means arresting said supply means upon a predetermined gate travel to a closed position, and means for initiating actuation of said supply means independently of said open position arresting means, said valve shifting means being active while said closed position arresting means is operative but not while said open position arresting means is operative.

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