

June 12, 1951

J. S. GOODWIN

2,556,531

MECHANISM FOR THE CONTROL AND OPERATION OF GATES

Filed Aug. 20, 1949

2 Sheets-Sheet 1

Fig. 1.

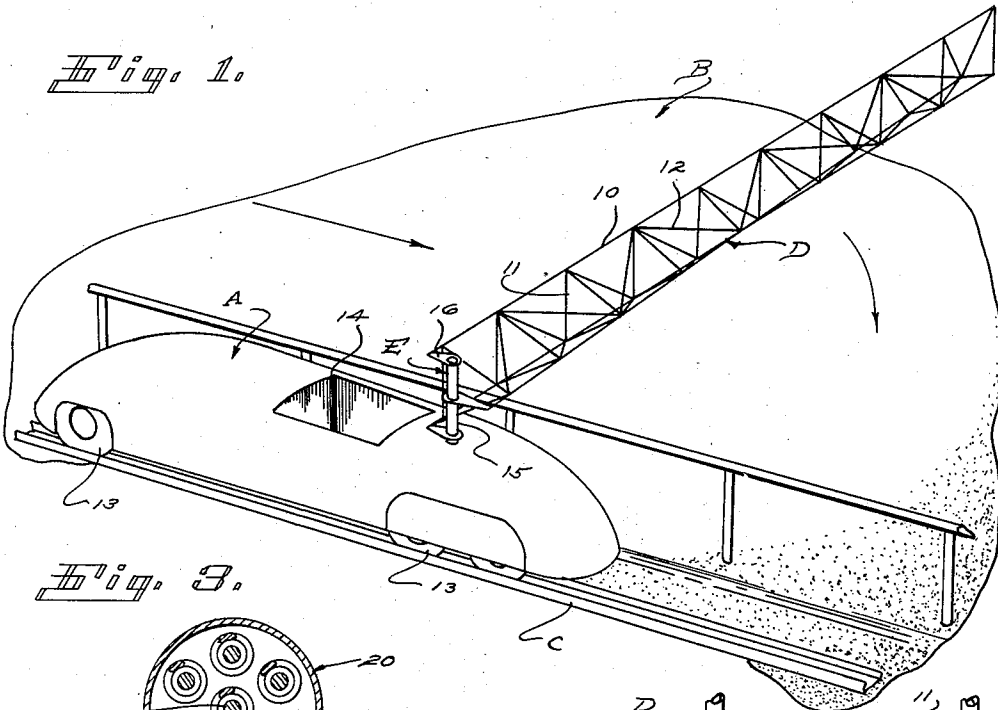


Fig. 3.

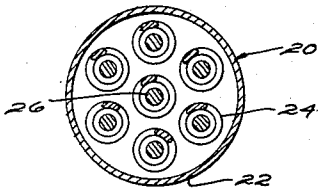


Fig. 2.

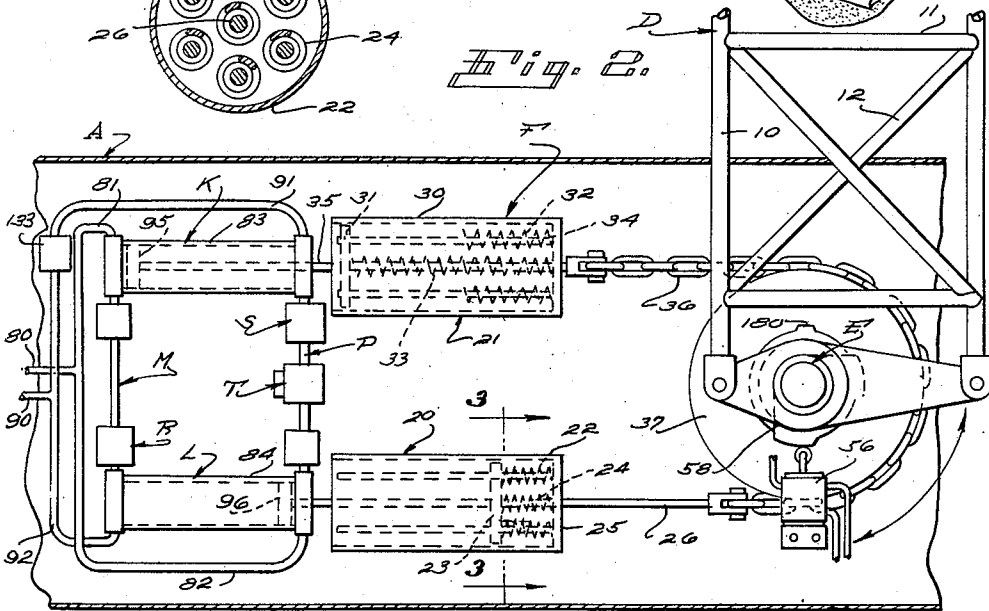
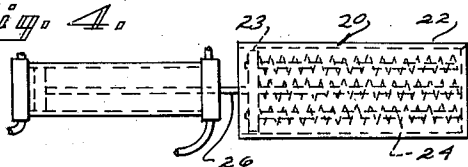


Fig. 4.



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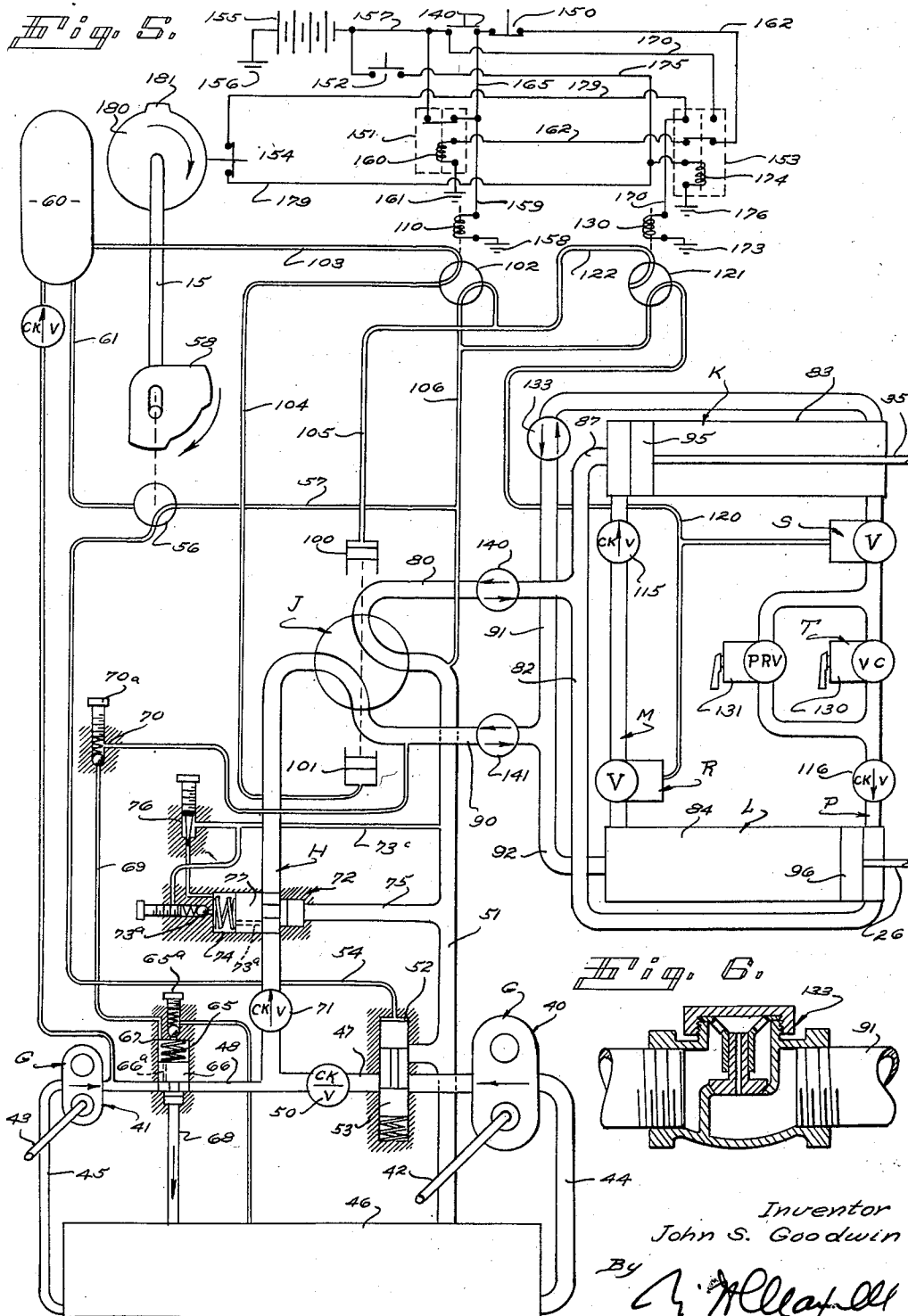
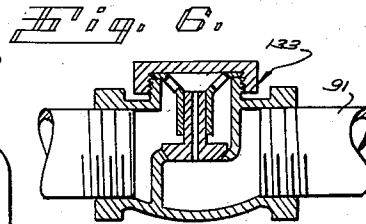
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## MECHANISM FOR THE CONTROL AND OPERATION OF GATES

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2 Sheets-Sheet 2



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## UNITED STATES PATENT OFFICE

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MECHANISM FOR THE CONTROL AND  
OPERATION OF A GATE

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30 Claims. (Cl. 39—1)

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This invention is concerned with a mechanism for the control and operation of a gate and it is a general object of the invention to provide a structure or mechanism which is simple, effective, and dependable for the operation and control of a gate such as may be used on or in connection with a race track for the control of horses, or the like.

The mechanism including the salient features of the present invention involves a gate in the form of an elongate element or arm carried by a vehicle such as a motor vehicle to operate about a vertical axis. An operating means, preferably mechanical, is provided for rapidly operating the gate from a closed position to an open position, and it is preferred that this mechanism be spring actuated. A hydraulic system is combined with or related to the operating means and is operable to close or cock the gate, to release the gate for operation under the action or influence of the operating means, and to check or snub the action of the gate to maintain the speed and motion of the gate within desired limits. A control system incorporated in the hydraulic system enables the hydraulic system to be operated at will to either open or close the gate at moderate and safe speeds, and locks or sets the mechanism against rapid opening movement of the gate under the influence of the springs when the gate is being operated hydraulically.

The hydraulic system involves, generally, a pressure generating means, preferably characterized by a main high pressure large volume pump and a make-up pump which is a high pressure small volume pump. The pumps are supplied from a reservoir and outlets from the pumps extend to a main pressure line through suitable valves or controls which, under certain conditions, effect bypassing of pumped fluid to the reservoir. A reversing valve is supplied in the main pressure line and has a connection to the reservoir and has cylinder lines that extend to cylinder and piston mechanisms coupled to operate with the operating means. One cylinder line has branches, one connected to one end of one cylinder and the other connected to the opposite end of the other cylinder. The other cylinder line has branches connected with the ends of the cylinder in a manner reversed from that of the first mentioned cylinder line. Through the reversing valve and the said connections the cylinder and piston units may be operated in either direction by pressure from the pumps.

Connections extend between corresponding ends of the cylinders and each is characterized

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by a trip valve and a check valve and it is preferred that the trip valves be normally closed and be provided with electric operating means that opens them under control of a switch. Flow occurs through the connections as the gate is operated by the spring actuating means. A speed control is provided in one of the connections and includes a manually regulated or operated throttle valve in the connection controlling flow there-through as the gate swings from the closed to the open position. It is preferred that a limited check valve be provided between the reversing valve and one of the cylinders to cooperate with the throttle valve. In the preferred construction a snubbing means is incorporated in the structure acting when the gate is operated hydraulically to prevent sudden movement or surging of the structure, the snubbing means being provided by locating suitable limited check valves in fluid handling connections which valves allow free flow in one direction and but limited flow in the opposite direction.

A gate such as is referred to in this disclosure when designed to control or to be used in connection with the starting of a horse race, or the like, is of substantial length and to be effective must be moved rapidly from the closed to the open position. In the case described this operation occurs while the gate is being operated on or carried by a motor vehicle. In practice a substantial amount of power is required to initiate opening action and when such power gets the gate in motion then the gate itself presents a problem in that its motion must be checked and finally stopped by the time the gate reaches the open position. The present invention provides, generally, mechanical means in the form of a spring mechanism that supplies force or energy to effect opening of the gate in the desired manner and a hydraulic system is provided for moving the gate between its two positions at any time, as circumstances may require. A suitable snubbing or control means is provided in the hydraulic system so that when the gate is operated hydraulically its motion and speed are controlled. An important feature of the invention is inclusion in the hydraulic system of a speed control preferably established by a throttle valve in the hydraulic system which acts to control or regulate the action of the gate when it is being opened under the influence of the mechanical operating means, which throttle valve can be effectively and conveniently set to compensate for varying factors that are encountered, such for example as wind resistance.

A general object of the present invention is to provide a gate operating mechanism with an actuating means related to a hydraulic system which hydraulic system includes a control or throttling means by which the action of the mechanism can be effectively adjusted or regulated to meet varying conditions such, for example, as wind resistance.

Another object of the invention is to provide a hydraulic system in a mechanism of the character described capable of operating the gate either to open the gate or to close the gate, which system includes a high pressure, large volume, pump employed when the gate is moved, and a high pressure, low volume, pump which acts to maintain the gate in a given position and to initiate movement of the gate from the open or closed position.

Another object of the invention is to provide a hydraulic system of the general character referred to including various flow controlling or regulating devices which operate to prevent sudden movement, surging, or undesirable operation of the moving parts of the mechanism.

It is another object of the invention to provide a mechanism of the character described in which a hydraulic system is so related and coupled to a spring actuated gate operator that the springs when allowed to work, swing the gate while the hydraulic system acts with the springs to govern or snub their action and to prevent reversal or back lash. With the present invention the mechanical parts are kept tight or without slack and the active forces are never allowed to act without check or regulation.

Another object of the invention is to provide a mechanism of the character described in which hydraulic pressure is available to open or close the gate slowly and smoothly whenever such action is desired.

The various objects and features of my invention will be fully understood from the following detailed description of a typical preferred form and application of the invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is a perspective view of a motor vehicle shown at a track and showing a gate carried by the vehicle and in a closed position or extending across the track. Fig. 2 is an enlarged detailed view of a portion of the mechanism provided by the present invention showing a mounting of the gate on the vehicle, the mechanical actuating means provided to operate the gate, and a part of the hydraulic system. Fig. 3 is an enlarged detailed transverse sectional view taken as indicated by line 3—3 on Fig. 2. Fig. 4 is a view of a part of the mechanism shown in Fig. 2 showing the parts in a different position. Fig. 5 is a diagrammatic view illustrating the hydraulic system provided by the present invention and Fig. 6 is a detailed sectional view of a limited check valve such as may be employed in carrying out the present invention.

The present invention is concerned primarily with a mechanism to be used in connection with or for the handling of a gate, or the like. The invention is particularly practical as applied to or for use in connection with a gate employed to control horses or the like in which case the gate may be related to a track or course. In the case illustrated the gate is shown mounted on or carried by a self-propelled vehicle A which is related to a track B, the vehicle being guided relative to the track by a guide rail C.

The mechanism embodying or in connection with which the present invention is provided involves, generally, the gate D shown as an elongate arm-like structure, mounting means F pivotally mounting the gate D on or from the vehicle A, actuating means F, preferably a mechanical means which operates to swing the gate as, for instance, from a closed position such as is shown in Fig. 1, to an open position where the gate is parallel with the vehicle, and a hydraulic system combined with or related to the actuating means F and involving features such as will be hereinafter described.

In the simple form of the invention illustrated the gate D involves a single elongate arm-like structure formed of longitudinal beams 10 spaced by struts 11 and braced by brace members 12.

The vehicle A is shown as involving an elongate body carried on suitable wheels 13 and provided with a driver's compartment or cockpit 14. The mounting means F may vary widely in form and construction. In the case illustrated it involves a shaft 15 carried by the vehicle A so that it is vertically disposed and projects above the body A at which point the inner end of the gate is fixed to the shaft, as by arms 16 which are secured to the shaft and to which beams of the gate are attached.

The operating means F is provided primarily to operate the gate rapidly from the closed position shown in Fig. 1 to an open position, which operation requires rapid movement of the gate through about 90° to a position where the gate is substantially parallel with the vehicle A. In practice the means F is a mechanical means and involves two pressure units, one a power unit 20 and the other a check unit 21.

The power unit 20, as shown in the drawings, involves a case 22 fixed in the vehicle, and a head 23 carried in the case and operable longitudinally therein. A plurality of compression springs 24 are arranged in the casing 22 to act under compression between the head 23 and end 25 of the case. A stem 26 is attached to or carries the head 23 and projects from the ends of the case. When the gate is open the head 23 is at what will be termed the outer end of the case and the several springs are extended as indicated in Fig. 4. When the gate is closed the head 23 approaches the inner end of the case and the springs 24 are compressed.

The unit 21 is similar, generally, to the unit 20 and is arranged parallel therewith and is spaced laterally from unit 20, preferably in a horizontal direction. The unit 21 involves a case 30 and a head 31 operates in the case while springs 32 and 33 are arranged in the case between the head 31 and the end 34 of the case. A stem 35 carries the head 31 and projects from the ends of the case. In the preferred form of the invention the spring 33 is of substantial length and is at all times under pressure between the head 31 and end 34 of the case, thus serving to keep the mechanism hereinafter described under suitable tension. The springs 32 are short springs extending only partly through the case from the end 34 and are put under compression between the head 31 and the end 34 as the gate approaches a fully open position.

A drive is provided between the stems of units 20 and 21 and the shaft 15. In the preferred form of the invention the drive involves a chain 36 having its ends fixed to the stems 26 and 35 projecting from the inner ends of the cases 22 and 30. The chain 36 extends around a sprocket like drum 37 on the shaft 15 and from Fig. 2 of

the drawings it will be apparent how operation of the units 20 and 21 results in operation of the chain 36, and consequent turning of the shaft 15 and swinging of the gate D.

The hydraulic system embodying the present invention is operable to move the gate between the open and closed positions, serves as a means for releasing the gate to be opened by the operating means F, and serves to check or snub the action of the gate, both the speed and motion of the gate, to keep these factors within reasonable limits. The hydraulic system involves, generally, pressure generating means G, a main pressure line H supplied with fluid under pressure by the means G, a reversing valve J controlling the flow delivered by the line H and having outlets suitably coupled with the ends of the cylinders of oppositely operating cylinder and piston units K and L, connections M and P between the ends of the cylinders of the units K and L, trip valves R and S controlling the connections M and P, respectively, a speed control T controlling connection P, and various other features of construction and arrangement of parts as will appear from the drawings and the following description.

The pressure generating means preferably includes a high pressure, a large volume pump 40 and a high pressure, low volume, pump 41. In a practical application of the invention such as is illustrated in Fig. 1 of the drawings, the pumps employed deliver operating fluid under a pressure of about 1000 pounds per square inch, the high volume pump delivering such pressure at the rate of about 25 gallons per minute and the low volume pump delivering such pressure at a rate of about two gallons per minute.

The pumps 40 and 41 are preferably driven constantly and in practice may be operated from any suitable source of power, such as a prime mover or the like. In the drawings drive shafts 42 and 43 are shown operating the pumps 40 and 41, respectively. Inlet or suction lines 44 and 45 supply the pumps 40 and 41, respectively, with fluid from a reservoir 46. Outlets 47 and 48 of the pumps 40 and 41, respectively, connect to and supply the main pressure line H.

In the preferred arrangement of parts a check valve 50 is provided in the outlet 47 of pump 40. A by-pass means is provided from outlet 47 ahead of the check valve 50 to an exhaust or return line 51 which conducts fluid to the reservoir 46. The by-pass connection preferably includes a valve 52 controlling the by-passing of fluid and the valve, as indicated in Fig. 5, is of a type wherein there is a fluid pressure actuated control element on which fluid from the pump 40 operates and tends to move to an open or by-passing position such as is shown in Fig. 5. A control pressure is supplied to the valve 52 through a high pressure line 54 and acts on the member 53 so that pressure may be supplied to member 53 to move it against the pressure from pump 40 closing the by-pass so that all fluid from pump 40 is delivered past the check valve 50 to the line H.

The high pressure line 54 is under control of a valve 56 which, in accordance with the present invention, admits high pressure to the valve 52 only when the gate is between the fully open or fully closed position. When the gate is either fully open or fully closed the valve 56 connects line 54 with an exhaust line 57. In the preferred arrangement the valve 56 is operated by a cam 58 on shaft 15. The cam is so shaped and proportioned as to properly coordinate operation of valve 56 with the position of the gate. The op-

erating pressure for the parts just described may be from a pressure supply or accumulator 60. A line 61 extends from the accumulator to valve 56.

A by-pass means is provided in connection with the outlet 48 of pump 41 and this by-pass means is primarily in the form of a pressure relief mechanism that operates at one pressure when the gate is open and at another pressure when the gate is closed.

The by-pass means for the low volume pump is shown as including a valve 65 with a valve element 66 normally held by a spring 67 in position where fluid cannot escape through the valve to the line 63. A limited escape bore 66<sup>a</sup> is provided through member 66 so fluid slowly passes through element 66 into the chamber above element 66. A regulating or adjusting valve 70, such as a spring loaded check valve, acts when the gate is open and is provided in a line 69 that extends from the chamber of valve 65 above element 66 to a cylinder line 90. Valve 70 is adjusted by a member 70<sup>a</sup> and resists flow from valve 65 to line 90 and checks reverse flow in line 69. When pressure above element 66 is greater than that for which valve 70 is set, the valve 70 opens and fluid escapes from valve 65 allowing the element 66 to operate against the resistance of spring 67 and allowing escape of fluid through the exhaust connection 62 to reservoir 46. When the gate is open there is low pressure in line 90, as will be apparent from the description to follow, and this pressure allows valve 70 to open when pressure in line 48 exceeds that necessary to hold the gate open.

A second regulating or adjusting valve 65<sup>a</sup>, such as a spring loaded relief valve, is provided to allow pressure to escape from the chamber of valve 65 when the gate is closed and there is high pressure in line 90 holding valve 70 against opening. Valve 65<sup>a</sup> is connected to the reservoir by an exhaust line and is such as to open when pressure in line 48 exceeds that necessary to hold the gate closed. It takes less pressure to hold the gate open than it does to hold it closed and, therefore, valve 70 is set to open at a lower pressure than valve 65<sup>a</sup>.

In the preferred form of the invention a check valve 71 is provided in the main high pressure line H before the line reaches the valve J and a pressure relief means or valve 72 is provided in the line H between the check valve 71 and the valve J. In the case illustrated the valve 72 involves a valve member 73 normally held by a spring 74 in a position where flow is confined to the line H. A limited port 73<sup>a</sup> is provided through element 73 so there is slow flow of fluid into the chamber at the outer side of element 73. A spring loaded safety valve 73<sup>b</sup> allows fluid to escape from the chest of valve 73 when pressure therein exceeds that at which the valves 65 and 70 operate. A secondary or supplementary control valve 76 may be provided in parallel with valve 73<sup>b</sup>. Valve 76 is shown as a manually operated needle valve and can be conveniently operated or adjusted as circumstances require. A discharge line 73<sup>c</sup> extends from the valves 73<sup>b</sup> and 76 to the exhaust line 51.

The main pressure line H extends to the valve J and normally maintains fluid under high pressure to the valve J. The exhaust line 51 connects with valve J to conduct fluid from the valve J to the reservoir 46. A cylinder line 80 connects with valve J and has branches 81 and 82 that connect to the outer end of the cylinder 83 of unit K and with the inner end of cylinder 84

of unit L respectively. A second cylinder line 90 has branches 91 and 92 that connect with the inner end of cylinder 83 and the outer end of cylinder 84, respectively.

Unit K is a cylinder and piston unit involving the cylinder 83 and a piston 95 that operates in the cylinder. Stem 35 of the unit 21 hereinabove described extends into the cylinder 83 and carries the piston 95. The unit L is a cylinder and piston mechanism, in which a piston 96 operates in cylinder 84 and is connected to or carried by stem 26 of unit 20. From the diagram it will be apparent that the reversing valve J and the connections just described are such that the valve J can be positioned to effect operation of the units K and L so that the pistons thereof move between the ends of the cylinders from a positioning of parts such as is shown in diagram 5 to an opposite arrangement where piston 95 is at the inner end of cylinder 83 and the piston 96 is at the outer end of cylinder 84.

A control or operating means is provided for reversing valve J and in the diagram this means is indicated as involving cylinder and piston units 100 and 101 operatively coupled to the valve J. High pressure operating fluid is supplied to the units 100 and 101 through a control valve 102. High pressure operating fluid from the accumulator 60 is supplied to valve 102 through a line 103. A line 104 from the valve 102 extends to unit 101 while a line 105 extends from valve 102 to unit 100. An exhaust line 106 from the valve 102 may connect into the main exhaust line 51.

The control valve 102 is preferably provided with an electric operating means so that it can be operated from any suitable point remote from the mechanism. In the case illustrated an electromagnetic actuating device is shown at 115 and is in a control circuit hereinafter described.

The connection M directly connects the outer end of cylinder 83 with the outer end of cylinder 84 and in the preferred arrangement the trip valve R is located in the connection M. It is preferred that a check valve 115 be provided in the connection M between the trip valve R and the cylinder 83, and that it be such as to allow flow only from the valve R to the cylinder 83.

The connection P is a direct connection between the inner end of cylinder 83 and the inner end of cylinder 84. Trip valve S is located in the connection P and it is preferred that a check valve 116 be included in connection P between the valve S and the cylinder 84. The check valve 116 is such that flow can only occur in the connection P from valve S to cylinder 84.

It is preferred that a single control means or control system be provided for operating the trip valves S and R so that these valves are simultaneously opened and closed and, in practice, it is preferred that control or operating means be subject to operation from a point remote from the valves. The control for the trip valves is related to the control for the reversing valve so that there is interlocking of the trip valves with the reversing valve to prevent the hydraulic system from opposing movement of the gate when the trip valves are operated.

In the case illustrated the valves S and R are indicated as hydraulically operated valves subject to operation by fluid pressure from a pressure line 120. Flow to line 120 is under control of a valve 121 supplied with pressure from the accumulator 60 through a line 122 connected into line 105 so that pressure is available to operate the valves S and R only when valve 102 is posi-

tioned so that pressure is supplied to line 105, causing operation of valve J to a position so that the gate opens. The arrangement and relationship of parts is such that when the valves are operated, as just described, the gate is opened by spring action that may be supplemented by the hydraulic system, and is closed by operation of the hydraulic system.

An electromagnetic actuating device 130 is shown provided to operate valve 121 and is shown in the electric circuit.

The means T is, in effect, a speed control for the gate acting when the trip valves S and R are open releasing the means F so that it is active to move the gate from the closed position to the open position, at which time flow occurs in connection P from cylinder 83 to cylinder 84.

The means T in its preferred form involves a throttle valve 130 in the connection P between the valve S and the cylinder 84. In the case illustrated a pressure relief valve 131 is provided in the bypass P between the valve S and the cylinder 84 and is connected in parallel with the throttle valve 130. Further, a limited action check valve 133 is provided in branch 91 that connects with the inner end of cylinder 83.

The throttle valve 130 is preferably a manually operable regulating or throttling valve by which the amount of flow through connection P may be regulated as desired. As an example of use of the throttle valve, when there is little or no wind the valve T will be set in an average position. If there is a substantial wind acting on the gate in the direction in which the vehicle is traveling then the valve 130 is closed down somewhat so that the force added to the gate by the wind does not so supplement the force imparted to the gate by the actuating means as to cause the gate to operate too rapidly. Again, if there is a head wind operating against the gate the valve 130 may be opened somewhat freeing the connection P so that the actuating means exerts such force on the gate as to open it at the desired speed in spite of the wind. In practice it has been found that through the exercise of skill and judgment the valve 130 can be set immediately before each operation or opening of the gate, with the result that the gate though large and heavy operates at the desired speed and without lag or without danger that would result from excessive speed.

The limited check valve 133 in branch 91 of cylinder line 90 may be a valve such as is illustrated in Fig. 6 of the drawings, and serves to allow free flow to the inner end of cylinder 83 while it checks flow from the inner end of cylinder 83 allowing only a limited amount of flow in that direction. By thus checking the flow through the branch 91 the valve controlled connection P is rendered effective for the purpose desired.

In the preferred embodiment of the invention limited action check valves 140 and 141 are provided in the cylinder lines 80 and 90, respectively. These valves may be of the type illustrated in Fig. 6. The valve 140 may be such as to allow free or full flow from valve J to the branches 81 and 82 while it has limited checking action when there is a tendency for fluid to flow through the line 80 to the valve J. The valve 141 may be such as to allow full flow from valve J to the branches 91 and 92 while it has limited checking action when there is a tendency for fluid to flow toward the valve J. The valves 140 and 141 are effective when the hydraulic system is being operated to either open or close the gate and they serve to

limit the action of the hydraulic system so that the gate can only be operated by the hydraulic system at speeds which are safe. Further, the limited check valves in the system as described are effective in preventing undesirable operation or action such as might occur due to wind or other such factors if such checks were not provided.

With the general arrangement and relationship of elements above-described, the gate when open can be moved to the closed position by the hydraulic system which operation sets or cocks the springs which normally tend to move the gate to the open position. The reversing valve J is operable so that the gate can be operated hydraulically either from the open position to the closed position or from the closed position to the open position. When the trip valves S and R are operated or opened rapid operation or opening of the gate occurs under the influence of the springs. In accordance with the present invention the control valves 102 and 121 are so related and are under control of the electric system so that they can be operated causing the gate to be opened or closed hydraulically or so that the gate can be opened by the action of the springs at which time the hydraulic system acts with the springs so that both forces or mediums are acting to open the gate.

In the description above, control valve 102 has been described as operated by an electromagnetic actuating device 110 and control valve 121 has been described as operated by an electromagnetic actuating device 130. The devices 110 and 130 may in practice be solenoids, or the like, and in accordance with the present invention they are included in or may form a part of the electric control circuit indicated diagrammatically in Fig. 5 of the drawings.

The electric control circuit may vary widely and may, in practice, include numerous safety devices or refinements. In a simplified form, the electric circuit includes switches 140 and 150 which control the action or operation of the actuating devices 110 through a relay 151 and a switch 152 controlling the operation or action of the device 130 through a relay 153. Further, in accordance with the invention, the tripping action or the operation of the actuating device 130 which controls the valve 121 which in turn governs action of the tripping valves is under control of a switch 154 synchronized with the gate D.

The electric system is preferably provided with a suitable source of electric energy, as for instance, with a battery 155 one pole of which may be grounded as at 161 while the other is carried by what I will term a main line 157. The actuating device 110 and more specifically, the winding of that device, has one pole grounded as at 162 while the other pole is connected by means of a line 160 with the main line 157 through the relay 151. The relay 151 is a normally open relay with a winding 160 to be energized in order to close the relay and thus complete the circuit through line 159.

The winding 160 of relay 151 has one pole grounded as at 161 and has its other pole connected to the main line 157 by a line 162. The switches 140 and 150 are connected in series in line 162, switch 140 being a normally open switch while switch 150 is normally closed.

The switches 140 and 150 are connected in series between lines 157 and 162, switch 140 being adjacent line 157 while switch 150 is adjacent line 162. It is preferred to provide a holding circuit for the winding 160 so that by merely mo-

mentarily operating switch 140 the winding 160 is not only energized, but remains energized. In the arrangement illustrated, the holding circuit is carried by a line 165 which extends from line 162 between the switches 140 and 150 to line 159 between the relay 151 and the coil of the device 110.

Through this arrangement relay 151 is normally open and the control valve 102 related to the device 110 is normally in position where flow therethrough acts in the manner above-described so that the gate is opened or held open. When switch 140 is closed the circuit to the coil 160 of relay 151 is energized through the line 157, the line 162 and the ground 161. As soon as relay 151 closes, the circuit to the coil 160 remains closed through line 157, line 159, line 165 and line 162 and finally through ground 161. When relay 151 is closed the device 110 is energized or actuated operating control valve 102 so that the gate is moved from the open position to the closed position.

Assuming the valve 102 to have been actuated as above-described, at any time that it is desired to reverse valve 102 so that the gate is moved to the open position or is held in the open position, the switch 150 is actuated or opened thus breaking the circuit through line 162 so that the circuit through winding 160 is broken with the result that relay 151 opens and the device 110 returns to its normal unactuated position.

The trip valves S and R are normally closed and they are opened when control valve 121 is operated as by energization of the actuating device 130. The coil or winding of the device 130 is under control of switches 152 and 154 through the relay 153.

The relay 153 is a double throw relay which controls line 162 and also a line 170 extending from the main line 157 ahead of switch 140 to winding of the device 130. The line 170 connects to one pole of the winding of device 130, the other pole thereof being connected to ground as at 173. The relay 153 is so related to the lines 162 and 170 that the circuit through line 162 is normally closed while the circuit through line 170 is normally open and is only closed when the winding 174 of relay 153 is energized. The winding 174 of relay 153 is connected in a line 175 which extends from the main line 157 through switch 152 through the winding 174 and to ground at 173.

With this arrangement, closing of the normally open switch 152 results in energization of winding 174 so that winding 160 of relay 151 is opened while the circuit through line 170 and the winding of the actuating device 130 is closed. This results in operation of the control valve 102 to its normal unactuated position simultaneously with actuation of the control valve 121.

It is preferred to provide the relay 153 with a holding circuit so that when the switch 152 is closed as above-described, the winding 174 of relay 153 will remain energized. The holding circuit as illustrated in the drawings involves a line 179, which extends from one pole or contact of relay 153 to the winding 174 through the switch 154 and is energized when the relay 153 is actuated. The switch 154 is normally closed so that when the relay 153 is once actuated as by closing of switch 152, the relay is self-energized and remains closed.

The switch 154 is preferably coordinated with the gate so that it is opened only when the gate is open. In the case illustrated, a cam 180 op-

erated with the gate has a lobe or projecting part 181 located to engage and open switch 154 when the gate is in the open position. Through this arrangement, assuming the gate to be closed, operation or closing of switch 152 actuates relay 153 causing actuation of control 121 through device 130 at the same time that relay 153 is opened so that valve 102 returns to its normal position, and this condition prevails so long as the gate is in other than the fully open position. When the gate reaches the fully open position the cam 180 opens switch 154 thus opening the circuit to the winding 174 with the result that the relay 153 becomes unenergized or unactuated and ready for operation required for closing the gate.

From the foregoing description it will be apparent that the present invention provides a mechanical actuating means effective when released to rapidly move the gate from the closed to the open position. It will be apparent that the hydraulic system is such that it controls the mechanical actuating means and may be operated to release the mechanical actuating means for rapid operation of the gate at a time when the cylinder and piston units tend to hold the gate closed. Though the hydraulic system releases the operating means it never fully releases but at all times maintains it under control, so that dangerous or undesired operation cannot occur. Further, it will be apparent that by providing pressure generating means with two pumps the hydraulic system will operate at a satisfactory speed either to open or close the gate, in which case the high volume pump delivers the desired fluid while the low volume pump remains effective and active at all times to keep pressure in the hydraulic system and make up for leakage that inevitably occurs in a system of the character described.

Having described only a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art and fall within the scope of the following claims.

Having described my invention, I claim:

1. In combination with a pivotally mounted gate, spring powered operating means under pressure when the gate is closed tending to swing it open, and a hydraulic system including, two oppositely operating cylinder and piston units coupled to the operating means to operate therewith, fluid connections between the ends of the cylinders of said units, and a manually adjustable throttle valve in one of the fluid connections.

2. In combination with a pivotally mounted gate, spring powered operating means under pressure when the gate is closed tending to swing it open, and a hydraulic system including, two oppositely operating cylinder and piston units coupled to the operating means to operate therewith, fluid connections between the ends of the cylinders of said units, and a manually adjustable throttle valve in one of the fluid connections, both fluid connections having a check valve therein.

3. In combination, a gate, means pivotally supporting the gate, operating means including, two spring units, one including a reciprocating member operated the length of its stroke by a spring and the other including a reciprocating member operating oppositely to the first mentioned member and checked near one end of its

movement by a spring, and a drive connecting said members and the gate, and a hydraulic system including oppositely operating cylinder and piston units one coupled to each of said members, fluid connections between the ends of the cylinders of the last mentioned units, and a throttle valve in one of said fluid connections.

4. In combination, a gate, means pivotally supporting the gate, operating means including, two spring units, one including a reciprocating member operated the length of its stroke by a spring and the other including a reciprocating member operating oppositely to the first mentioned member and checked near one end of its movement by a spring, and a drive connecting said members and the gate, and a hydraulic system including oppositely operating cylinder and piston units one coupled to each of said members, fluid connections between the ends of the cylinders of the last mentioned units, check valves in said fluid connections, and a throttle valve in one of said fluid connections.

5. In combination with a pivotally mounted gate, spring powered operating means under pressure when the gate is closed tending to swing it open, and a hydraulic system including, two oppositely operating cylinder and piston units coupled to the operating means to operate therewith, fluid connections between the ends of the cylinders of said units, trip valves in the fluid connections, and a throttle valve in one of the fluid connections.

6. In combination with a pivotally mounted gate, spring powered operating means under pressure when the gate is closed tending to swing it open, and a hydraulic system including, two oppositely operating cylinder and piston units coupled to the operating means to operate therewith, and fluid connections between the ends of the cylinders of said units, one fluid connection having a check valve and a trip valve therein, and the other fluid connection having a check valve, a trip valve, a throttle valve and a pressure relief valve therein, the throttle valve and relief valve being connected in parallel.

7. In combination with a pivotally mounted gate, spring powered operating means under pressure when the gate is closed tending to swing it open, and a hydraulic system including, two oppositely operating cylinder and piston units coupled to the operating means to operate therewith, fluid connections between the ends of the cylinders of said units, a throttle valve in one of the fluid connections, a source of fluid pressure, a reversing valve controlling fluid from said source, and fluid connections between said reversing valve and the ends of the cylinders of said units so fluid is conducted to and from the cylinders to operate the units in either direction.

8. In combination with a pivotally mounted gate, spring powered operating means under pressure when the gate is closed tending to swing it open, and a hydraulic system including, two oppositely operating cylinder and piston units coupled to the operating means to operate therewith, fluid connections between the ends of the cylinders of said units, a throttle valve in one of the fluid connections, a source of fluid pressure, a reversing valve controlling fluid from said source, fluid connections between said reversing valve and the ends of the cylinders of said units so fluid is conducted to and from the cylinders to operate the units in either direction, and limited check valves in the last mentioned fluid connections.

9. In combination with a pivotally mounted gate, spring powered operating means under pressure when the gate is closed tending to swing it open, and a hydraulic system including, two oppositely operating cylinder and piston units coupled to the operating means to operate therewith, fluid connections between the ends of the cylinders of said units, a throttle valve in one of the fluid connections, a source of fluid pressure, a reversing valve controlling fluid from said source, fluid connections between said reversing valve and the ends of the cylinders of said units so fluid is conducted to and from the cylinders to operate the units in either direction, and a limited check valve in the last mentioned connection from the end of the cylinder from which flow is governed by the throttle valve.

10. In combination with a pivotally mounted gate, spring powered operating means under pressure when the gate is closed tending to swing it open, and a hydraulic system including, two oppositely operating cylinder and piston units coupled to the operating means to operate therewith, fluid connections between the ends of the cylinders of said units, one fluid connection having a check valve and a trip valve therein, and the other fluid connection having a check valve, a trip valve, a throttle valve and a pressure relief valve therein, the throttle valve and relief valve being connected in parallel, a source of fluid pressure, a reversing valve controlling fluid from said source, and fluid connections between said reversing valve and the ends of the cylinders of said units so fluid is conducted to and from the cylinders to operate the units in either direction.

11. In combination with a pivotally mounted gate, spring powered operating means under pressure when the gate is closed tending to swing it open, and a hydraulic system including, two oppositely operating means to operate therewith, fluid connections between the ends of the cylinders of said units, a throttle valve in one of the fluid connections, a source of fluid pressure, a reversing valve controlling fluid from said source, and fluid connections between said reversing valve and the ends of the cylinders of said units so fluid is conducted to and from the cylinders to operate the units in either direction, the source of fluid pressure including, a high pressure large volume pump, and a high pressure low volume pump.

12. In combination with a pivotally mounted gate, spring powered operating means under pressure when the gate is closed tending to swing it open, and a hydraulic system including, two oppositely operating means to operate therewith, fluid connections between the ends of the cylinders of said units, a throttle valve in one of the fluid connections, a source of fluid pressure, a reversing valve controlling fluid from said source, and fluid connections between said reversing valve and the ends of the cylinders of said units so fluid is conducted to and from the cylinders to operate the units in either direction, the source of fluid pressure including, a high pressure large volume pump, a high pressure low volume pump, and fluid by-passing means in the outlets of said pumps.

13. In combination, a gate, means pivotally supporting the gate, operating means including, two spring units, one including a reciprocating member operated the length of its stroke by a spring and the other including a reciprocating member operating oppositely to the first men-

tioned member and checked near one end of its movement by a spring, and a drive connecting said members and the gate, and a hydraulic system including oppositely operating cylinder and piston units one coupled to each of said members, a fluid handling line, a reservoir carrying fluid, pump means receiving fluid from the reservoir and delivering it under pressure to said line, a reversing valve controlling the fluid delivered by said line, and cylinder connections between the reversing valve and the ends of the cylinders.

14. In combination, a gate, means pivotally supporting the gate, operating means including, two spring units, one including a reciprocating member operated the length of its stroke by a spring and the other including a reciprocating member operating oppositely to the first mentioned member and checked near one end of its movement by a spring, and a drive connecting said members and the gate, and a hydraulic system including oppositely operating cylinder and piston units one coupled to each of said members, a fluid handling line, a reservoir carrying fluid, pump means receiving fluid from the reservoir and delivering it under pressure to said line, a reversing valve controlling the fluid delivered by said line, cylinder connections between the reversing valve and the ends of the cylinders, and limited check valves in the cylinder connections.

15. In combination, a gate, means pivotally supporting the gate, operating means including, two spring units, one including a reciprocating member operated the length of its stroke by a spring and the other including a reciprocating member operating oppositely to the first mentioned member and checked near one end of its movement by a spring, and a drive connecting said members and the gate, and a hydraulic system including oppositely operating cylinder and piston units one coupled to each of said members, a fluid handling line, a reservoir carrying fluid, pump means receiving fluid from the reservoir and delivering it under pressure to said line, a reversing valve controlling the fluid delivered by said line, and cylinder connections between the reversing valve and the ends of the cylinders, the pump means including, a large volume pump and a small volume pump, each with a bypass means carrying fluid to the reservoir.

16. In combination, a gate, means pivotally supporting the gate, operating means including, two spring units, one including a reciprocating member operated the length of its stroke by a spring and the other including a reciprocating member operating oppositely to the first mentioned member and checked near one end of its movement by a spring, and a drive connecting said members and the gate, and a hydraulic system including oppositely operating cylinder and piston units one coupled to each of said members, a fluid handling line, a reservoir carrying fluid, pump means receiving fluid from the reservoir and delivering it under pressure to said line, a reversing valve controlling the fluid delivered by said line, cylinder connections between the reversing valve and the ends of the cylinders, and a pressure controlled bypass from the fluid handling line to the reservoir.

17. In combination, a gate, means pivotally supporting the gate, operating means including, two spring units, one including a reciprocating member operated the length of its stroke by a spring and the other including a reciprocating member operating oppositely to the first men-

tioned member and checked near one end of its movement by a spring, and a drive connecting said members and the gate, and a hydraulic system including oppositely operating cylinder and piston units one coupled to each of said members, a fluid connection between the cylinders of the last mentioned units and having a trip valve and a check valve therein, a second fluid connection between the cylinders of the last mentioned means and having a check valve, a trip valve, and a pressure relief valve and a throttle valve therein, the relief valve and throttle valve being in parallel, a reservoir, a pressure line, pump means receiving fluid from the reservoir and delivering it under pressure to the line, a reversing valve, and cylinder connections between the reversing valve and the ends of said cylinders.

18. In combination, a gate, means pivotally supporting the gate, operating means including two spring units, one including a reciprocating member operated the length of its stroke by a spring and the other including a reciprocating member operating oppositely to the first mentioned member and checked near one end of its movement by a spring, and a drive connecting said members and the gate, and a hydraulic system including oppositely operating cylinder and piston units one coupled to each of said members, a fluid connection between the cylinders of the last mentioned units and having a trip valve and a check valve therein, a second fluid connection between the cylinders of the last mentioned means and having a check valve, a trip valve, and a pressure relief valve and a throttle valve therein, the relief valve and throttle valve being in parallel, a reservoir, a pressure line, pump means receiving fluid from the reservoir and delivering it under pressure to the line, a reversing valve, cylinder connections between the reversing valve and the ends of said cylinders, and limited action check valves in the cylinder connections.

19. In combination, a pivotally mounted gate, mechanical operating means operating the gate from a closed position to an open position, and a hydraulic system including, oppositely operating cylinder and piston units coupled with the operating means to operate therewith, a reservoir, a reversing valve controlling flow of fluid to and from the ends of the cylinders of said units, pressure generating means supplying fluid under pressure to the reversing valve, the generating means including a high volume pump and a low volume pump, and means by-passing flow from the high volume pump to the reservoir only when the gate is in said positions.

20. In combination, a pivotally mounted gate, mechanical operating means operating the gate from a closed position to an open position, and a hydraulic system including, oppositely operating cylinder and piston units coupled with the operating means to operate therewith, a reservoir, a reversing valve controlling flow of fluid to and from the ends of the cylinders of said units, pressure generating means supplying fluid under pressure to the reversing valve, the generating means including a high volume pump and a low volume pump, and means by-passing flow from the high volume pump to the reservoir only when the gate is in said positions including, a control valve and a cam operating with the gate and actuating the control valve.

21. In combination, a pivotally mounted gate, mechanical operating means operating the gate from a closed position to an open position, and

a hydraulic system including, oppositely operating cylinder and piston units coupled with the operating means to operate therewith, a reservoir, a reversing valve controlling flow of fluid to and from the ends of the cylinders of said units, pressure generating means supplying fluid under pressure to the reversing valve, the generating means including a high volume pump and a low volume pump, and means by-passing flow from the high volume pump to the reservoir only when the gate is in said positions including, a fluid pressure controlled by-pass valve, fluid pressure control means for the by-pass valve including a control valve, and a cam operating with the gate and actuating the control valve.

22. In combination, a pivotally mounted gate, mechanical operating means operating the gate from a closed position to an open position, and a hydraulic system including, oppositely operating cylinder and piston units coupled with the operating means to operate therewith, connections between the ends of the cylinders of said units each including a check valve and a trip valve and one including a throttle valve, a reservoir, a reversing valve controlling flow of fluid to and from the ends of the cylinders of said units, pressure generating means supplying fluid under pressure to the reversing valve, the generating means including a high volume pump and a low volume pump, and means by-passing flow from the high volume pump to the reservoir only when the gate is in said positions.

23. In combination, a pivotally mounted gate, mechanical operating means operating the gate from a closed to an open position, and a hydraulic system including, oppositely operating cylinder and piston units coupled with the operating means to operate therewith, connections between the ends of the cylinders of said units and each including a trip valve, a reservoir, a reversing valve controlling flow to and from the ends of said cylinders, pressure generating means supplying fluid under pressure to the reversing valve, and means operating the reversing valve and trip valves and including a control supplying operating pressure to the reversing valve to position it so the said units open the gate when the trip valves are open.

24. In combination, a pivotally mounted gate, mechanical operating means operating the gate from a closed to an open position, and a hydraulic system including, oppositely operating cylinder and piston units coupled with the operating means to operate therewith, connections between the ends of the cylinders of said units and each including a trip valve and a check valve and one including a throttle valve, a reservoir, a reversing valve controlling flow to and from the ends of said cylinders, pressure generating means supplying fluid under pressure to the reversing valve, and means operating the reversing valve and trip valves and including a control for supplying operating pressure to the trip valves only when the reversing valve is positioned for opening of the gate.

25. In combination, a pivotally mounted gate, mechanical operating means operating the gate from a closed to an open position, and a hydraulic system including, oppositely operating cylinder and piston units coupled with the operating means to operate therewith, connections between the ends of the cylinders of said units and each including a trip valve, a reservoir, a reversing valve controlling flow to and from the ends of said cylinders, pressure generating means sup-

plying fluid under pressure to the reversing valve, and means operating the reversing valve and trip valves and including a system handling operating fluid for the reversing valve and trip valves, a control valve controlling flow of operating fluid to the trip valves, a second control valve passing operating fluid to the reversing valve and controlling flow of operating fluid to the first mentioned control valve, said second control valve operating to cut off operating fluid to the first mentioned control valve when passing operating fluid to the reversing valve to position the reversing valve for closing of the gate by operation of the said units.

26. In combination, a pivotally mounted gate, mechanical operating means operating the gate from a closed to an open position, and a hydraulic system including, oppositely operating cylinder and piston units coupled with the operating means to operate therewith, connections between the ends of the cylinders of said units and each including a trip valve, a reservoir, a reversing valve controlling flow to and from the ends of said cylinders, pressure generating means supplying fluid under pressure to the reversing valve, and means operating the reversing valve and trip valves and including, a system handling operating fluid for the reversing valve and trip valves, a control valve for controlling flow of operating fluid to the trip valves, a second control valve for passing operating fluid to the reversing valve and controlling flow of operating fluid to the first mentioned control valve, and cam means operating with the gate and controlling operation of the said first mentioned control valve so operating fluid to the trip valve is cut off when the gate reaches a fully open position.

27. In combination, a pivotally mounted gate, mechanical operating means operating the gate from a closed to an open position, and a hydraulic system including, oppositely operating cylinder and piston units coupled with the operating means to operate therewith, connections between the ends of the cylinders of said units and each including a trip valve, a reservoir, a reversing valve controlling flow to and from the ends of said cylinders, pressure generating means supplying fluid under pressure to the reversing valve, and means operating the reversing valve and trip valves and including a control supplying operating pressure to the reversing valve to position it so the said units close the gate only when the trip valves are closed and cut off from operating pressure, the means supplying fluid under pressure including, a high volume pump and a low volume pump operating simultaneously, the high volume pump having by-pass means delivering pumped fluid to the reservoir when the gate is in either of said positions.

28. In combination, a pivotally mounted gate, mechanical operating means operating the gate from a closed to an open position, and a hydraulic system including, oppositely operating cylinder and piston units coupled with the operating means to operate therewith, connections between the ends of the cylinders of said units and each including a trip valve and a check valve and one including a throttle valve, a reservoir, a reversing

ing valve controlling flow to and from the ends of said cylinders, pressure generating means supplying fluid under pressure to the reversing valve, and means operating the reversing valve and trip valves and including a control for supplying operating pressure to the trip valves only when the reversing valve is positioned for opening of the gate, said last mentioned means including control valves and an electric control system governing operation of the valves.

29. In combination, a pivotally mounted gate, mechanical operating means operating the gate from a closed to an open position, and a hydraulic system including, oppositely operating cylinder and piston units coupled with the operating means to operate therewith, connections between the ends of the cylinders of said units and each including a trip valve and a check valve and one including a throttle valve, a reservoir, a reversing valve controlling flow to and from the ends of said cylinders, pressure generating means supplying fluid under pressure to the reversing valve, and means operating the reversing valve and trip valves and including a control for supplying operating pressure to the trip valves only when the reversing valve is positioned for opening of the gate, said last mentioned means including control valves and an electric control system governing operation of the valves including switches and relays between the switches and the control valves.

30. In combination, a pivotally mounted gate, mechanical operating means operating the gate from a closed to an open position, and a hydraulic system including, oppositely operating cylinder and piston units coupled with the operating means to operate therewith, connections between the ends of the cylinders of said units and each including a trip valve and a check valve and one including a throttle valve, a reservoir, a reversing valve controlling flow to and from the ends of said cylinders, pressure generating means supplying fluid under pressure to the reversing valve, and means operating the reversing valve and trip valves and including a control for supplying operating pressure to the trip valves only when the reversing valve is positioned for opening of the gate, said last mentioned means including, a control valve for the reversing valve, a control valve for the trip valves, and an electric system including a switch controlled circuit governing the control valve for the reversing valve, a switch controlled circuit governing the control valve for the trip valves, and a cut out switch in the last mentioned circuit controlled by the gate and normally rendering the circuit operative only when the gate is in other than the open position.

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