Feb. 28, 1939. M. McD. DILLEY 2,148,733

CROSSING GATE STRUCTURE

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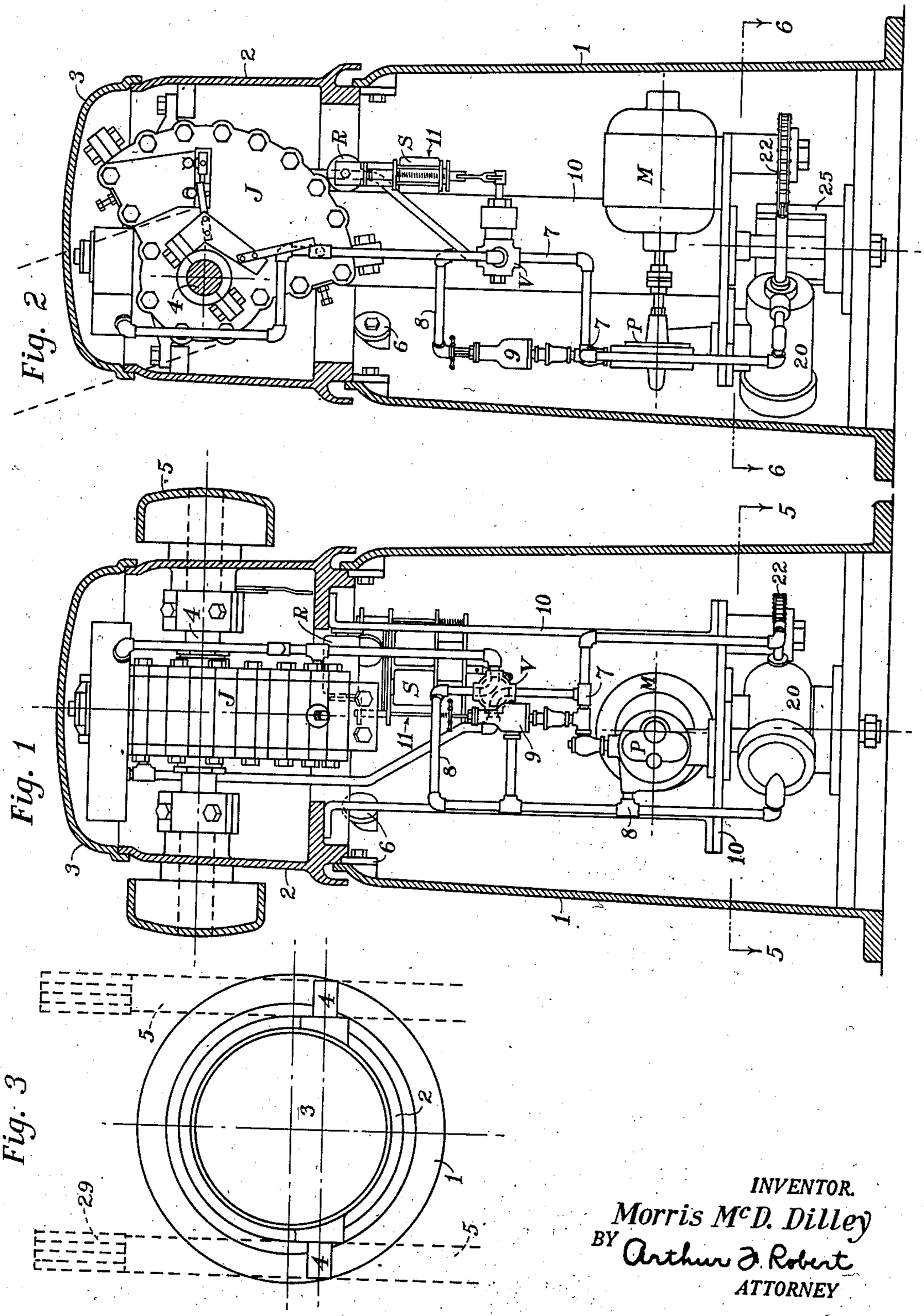

Fig. 2

Fig. 1

Fig. 3

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Fig. 4

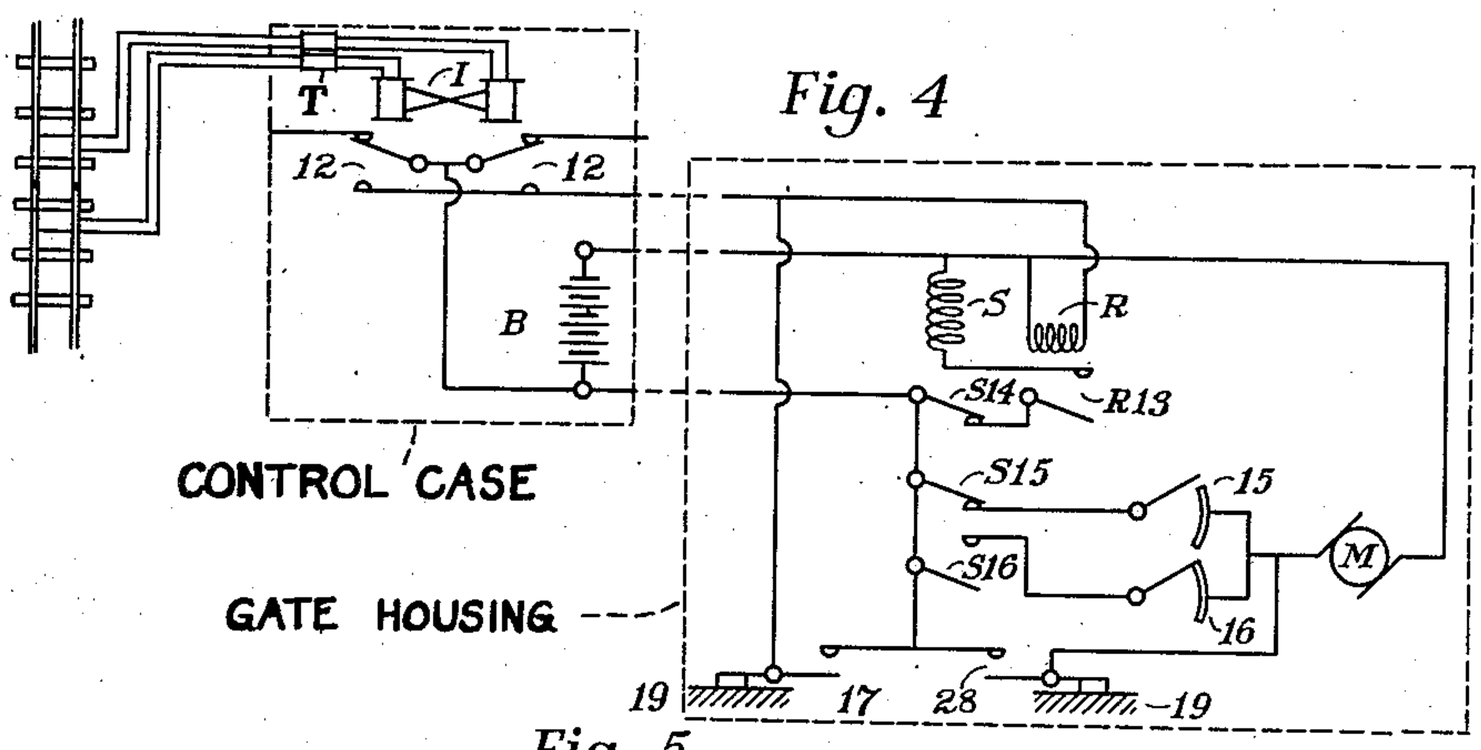


Fig. 5

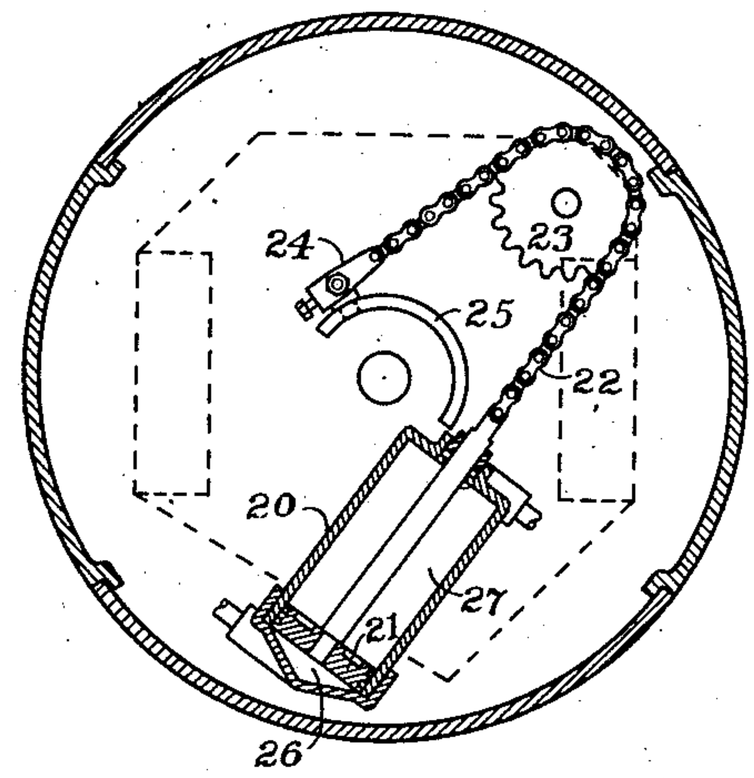


Fig. 6

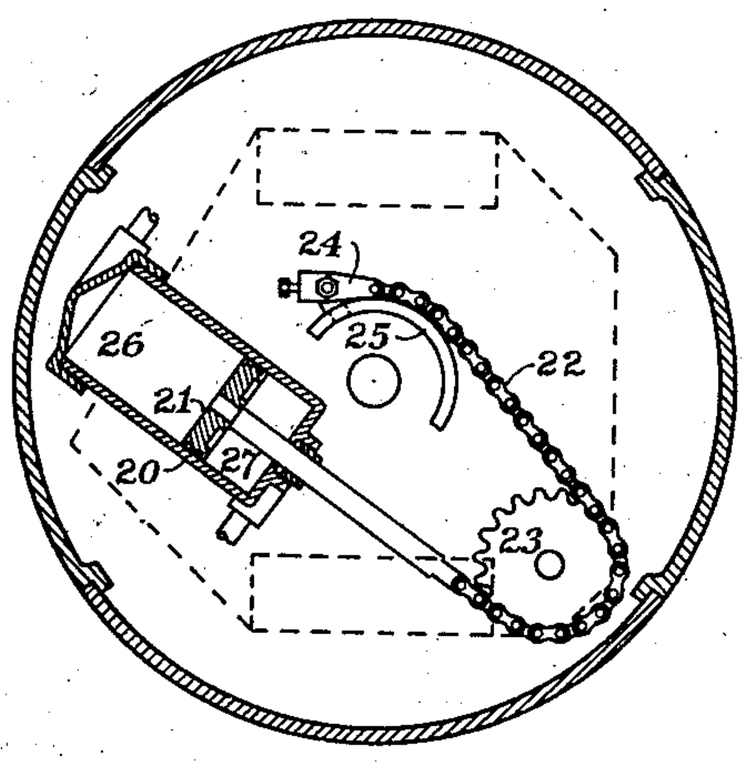


Fig. 7

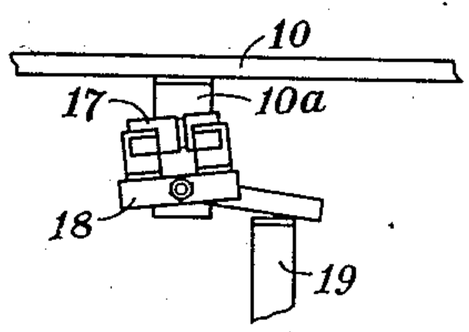
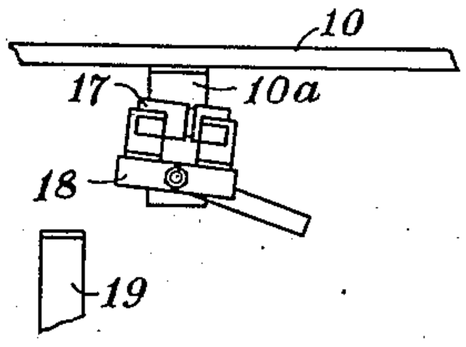


Fig. 8



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CROSSING GATE STRUCTURE

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Fig. 9

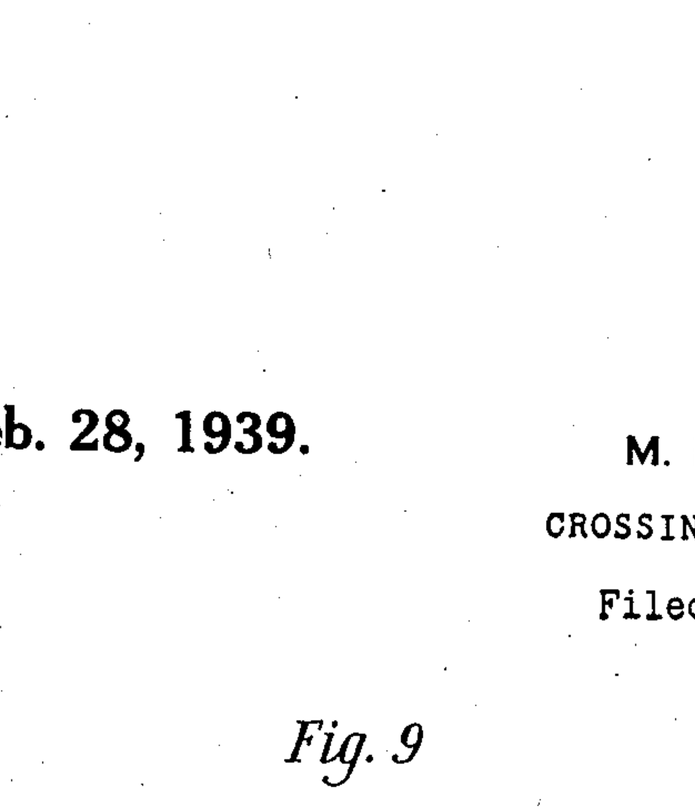


Fig. 10

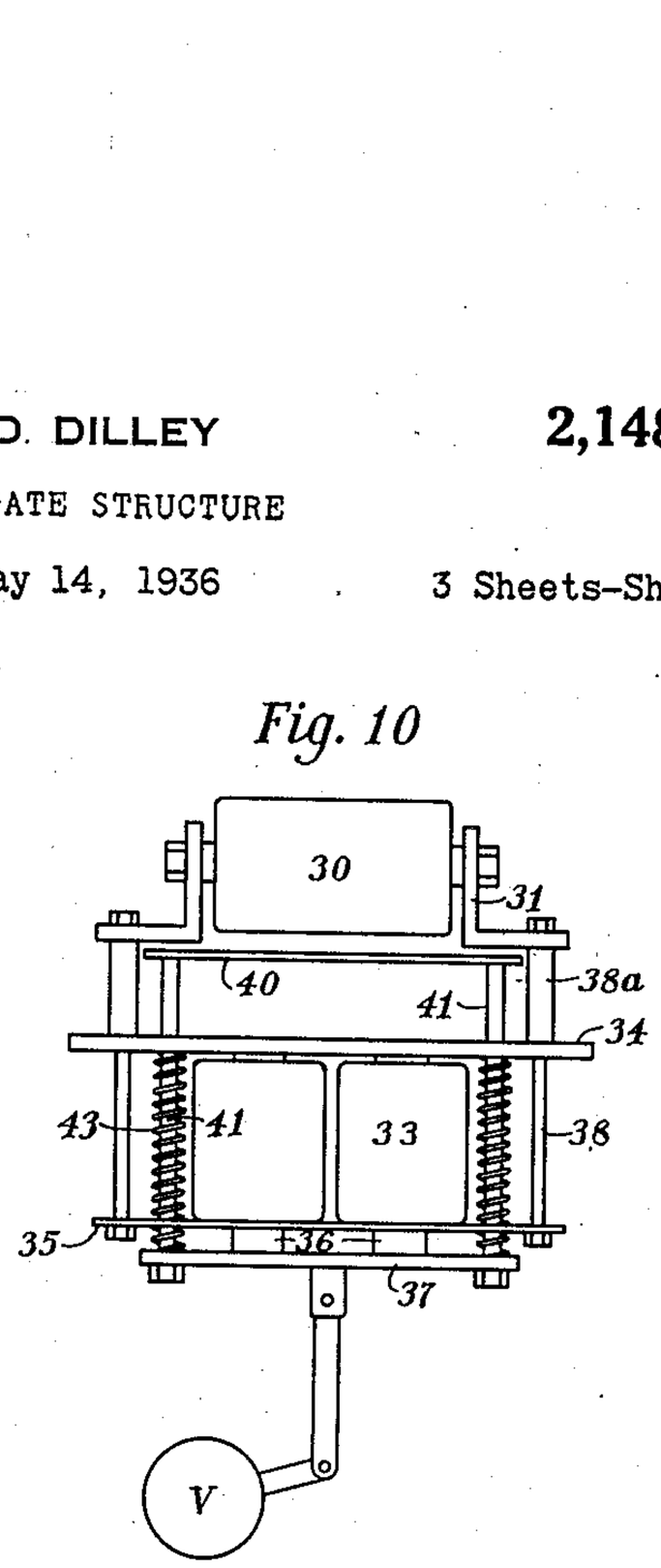


Fig. 11

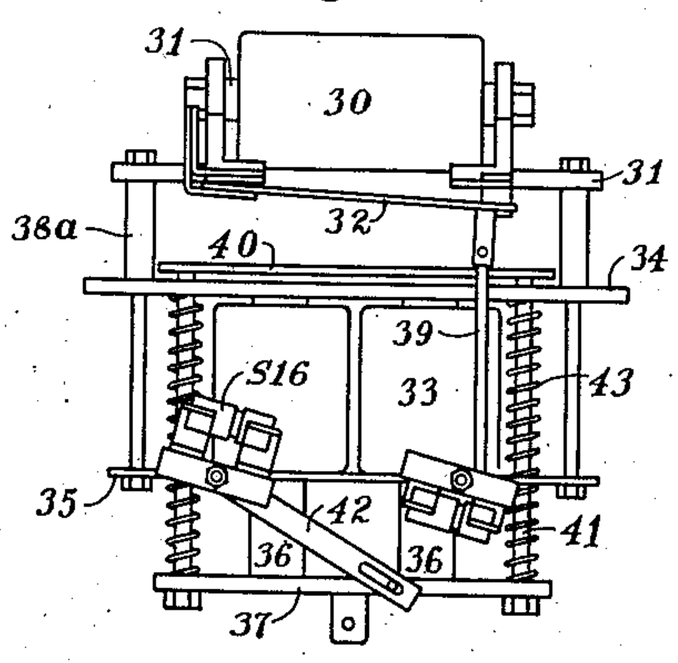


Fig. 12

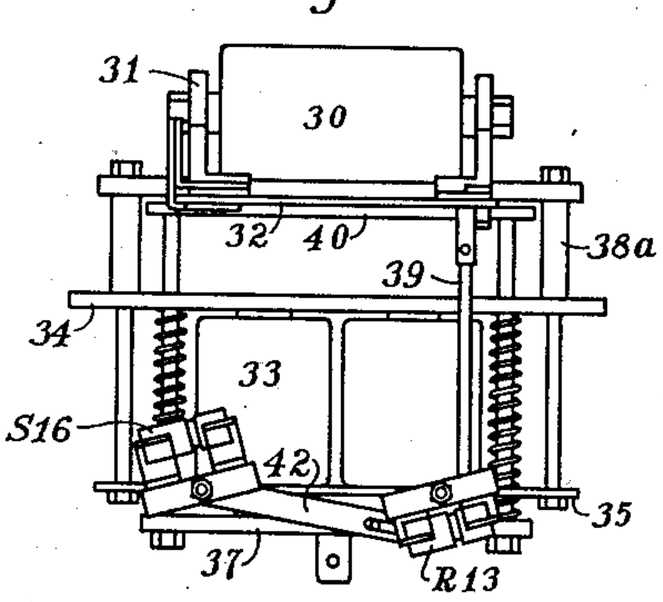
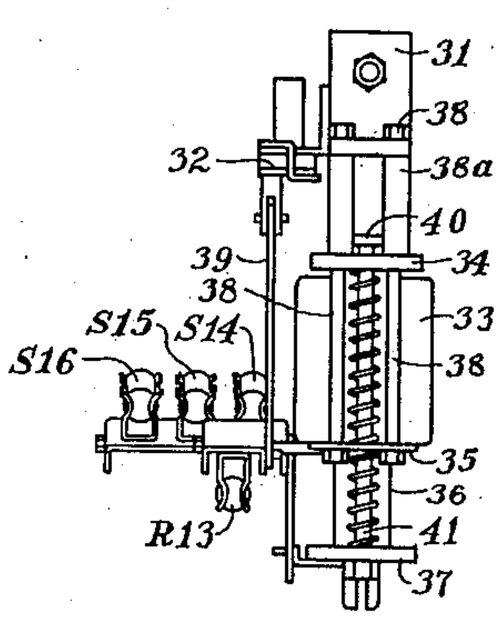


Fig. 13



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Patented Feb. 28, 1939 2,148,733

UNITED STATES PATENT OFFICE

2,148,733

CROSSING GATE STRUCTURE

Morris McD. Dilley, Louisville, Ky., assignor to Associated Manufacturers' Agency, Louisville, Ky., a corporation of Kentucky

Application May 14, 1936, Serial No. 79,727

14 Claims. (Cl. 39—8)

Conventional crossing gate structures, which are employed at railroad crossings to stop highway traffic during the approach of a train, usually comprise a hollow standard, a hollow head mounted on the upper end of the standard for limited horizontal movement out of its normal position, a gate pivotally supported by the head for vertical movement into and out of operative position, and gate operating mechanism for moving the gate vertically. The head and standard usually carry co-operating stop lugs which prevent the gate from being swung out of its normal vertical plane of operation horizontally toward the crossing but permit such movement in the opposite direction away from the crossing so as to enable a vehicle trapped on the crossing between lowered gates to strike and swing a gate and thus escape from the crossing with little or no damage either to the gate or to the vehicle.

Various arrangements have been proposed to return a horizontally swung gate to its normal vertical plane of operation but these have been characterized by one or more features of structure or operation which are objectionable because they unduly complicate the gate structure, or permit the gate to rise before it returns to normal position, or offer increasing resistance to turning as the gate is swung outwardly, sometimes sufficient either to cause damage during the outward swing or to build up a return force great enough to occasion damage when the gate reaches its normal position where further horizontal movement is prevented.

The present invention, which relates to the return mechanism, has for its principal object the provision of a return mechanism which is not characterized by any of the foregoing objections. More specifically, the objects are: to provide an inexpensive return mechanism of simple character; to provide one which prevents the rise of the gate while it is out of its normal position; to provide one which requires the same easy turn force at any point in its outward travel; and to provide one which not only returns the gate at a uniform speed but at a designed rate of speed that can be made low enough to prevent any possibility of damage.

A further object is to provide a return mechanism which can be made to move a gate automatically from one of its positions to a caution position intermediate its up and down positions, upon a power failure.

The invention is illustrated in the accompanying drawings wherein—

Figure 1 is a vertical section through a gate structure which embodies my invention;

Figure 2 is a similar section with the head turned 90 degrees;

Figure 3 is a top plan view thereof with the gate (broken off) and counterweight, indicated in dotted lines;

Figure 4 is a schematic view of a suitable control system for the structure illustrated;

Figure 5 is a section taken through line 5—5, Figure 1;

Figure 6 is a section taken through line 6—6, Figure 2;

Figure 7 is a detail showing the return mechanism control switches in their normal position;

Figure 8 is a similar detail showing the return mechanism switches as they appear immediately after the head has been initially turned out of its normal position;

Figures 9 and 10 are rear elevations of a relay solenoid constructed in accordance with the invention, the figures showing the parts in the gate up and gate down positions respectively;

Figures 11 and 12 are corresponding front elevations thereof; and

Figure 13 is a side elevation.

The structure illustrated comprises a hollow cylindrical standard 1, a hollow cylindrical head 2 mounted on the standard, a detachable cap 3 mounted on the head, and a gate shaft 4 which passes horizontally through the head and upon which the gate 5 is mounted. The head is rotatably mounted on the standard through the agency of a series of rollers 6 carried at the upper end of the standard. The rollers engage an over-lying track on the head and, in the normal position of the head, extend into a similar series of recesses so that the head will be elevated when horizontally turned. The rollers and recesses are spaced irregularly in such fashion that they match only in the normal position of the head whereby the latter remains elevated as long as it remains out of its normal position. It will be understood that suitable stop lugs are provided between head and standard which prevent turning movement of gate from normal position toward or across the tracks but which permit movement in opposite direction.

Any suitable gate operating mechanism may be employed, such as the one described and claimed in the application of Henry F. Hawes, filed May 14, 1936, and serially numbered 79,728. The mechanism therein and herein shown is of a jack type which comprises a piston-cylinder or jack J, a flow control valve V, a pump P, and a

motor M. The piston of the jack is connected to the gate shaft so as to lower the gate when moved one way and raise it when moved the other. The gate raising and lowering chambers of the jack are respectively connected by pipes to the valve V, which, in its normal or gate raising position, connects the gate raising and gate lowering chambers of the jack respectively to the supply and suction sides 7 and 8 of the pump and in its other or gate lowering position reverses these connections. The supply and suction sides of the pump are connected to each other through a pressure relief valve 9. The pump and motor are preferably mounted on a U-shaped bracket 10, which depends from the inner end of the head so as to turn therewith.

The valve V may be operated in any suitable way but preferably is operated by a combined relay solenoid 11 of the character described in the latter part of this specification. The relay solenoid 11 is mounted on the U-shaped bracket. Its operation can be determined by referring to the control system shown in Figure 4. In this system, it will be noted that the interlocking relays I normally, that is to say, when the gate is up, maintain open the circuit of the relay R of relay solenoid 11. When a train enters the protected block from one direction, the corresponding interlocking relay I will cause the corresponding one of the interlocking relay switches 12 to be operated so as to place the control relay R across the battery B. The energization of the relay R causes switch R13 to close, thus placing the solenoid S of the relay solenoid across the battery B. With the energization of the solenoid an operating member or solenoid carriage is moved from one position to another and is held in such other position by the relay R. This operating member, in moving to the relay holding position, operates a normally closed switch S14 to open its own circuit and thus effect its deenergization. The operating member at the same time opens a normally closed switch S15 which is in series with the up limit switch 15 of the motor and closes a normally open switch S16 which is in series with the down limit switch 16 of the motor. In this manner, the motor is placed across the battery through its down circuit and the gate thus moved from its up to its down position, in which position the motor circuit is opened by the down limit switch 16. Thus, it will be seen that, when the control relay R is energized, it causes the solenoid circuit to be energized and the operating member to be moved from one position to another and that, as long as the control relay R remains energized, the operating member will remain in said other or operated position. Since the operating member, in moving to its operated position, opens both the solenoid circuit switch, S14, and the motor up circuit switch S15, and closes the motor down circuit switch S16, it will be further evident that these parts remain in their respective operated positions as long as the relay remains energized.

The relay R remains energized until the train leaves the protected block. When this occurs, the proper interlocking relay I operates the corresponding switch 12 to open the relay circuit. The relay circuit thereupon opens the solenoid circuit through switch R13 and permits the operating member to be returned to its normal position by a spring (not shown) thereby not only returning the valve to the position in which it conditions the operating mechanism for the up movement, but at the same time closing the motor up circuit switch S15 to initiate the gate raising movement of the operating mechanism which movement continues until the gate is in the up position whereupon the motor circuit is opened by the up limit switch 15. In addition, of course, the operating member closes the solenoid circuit switch S14 and opens the motor down circuit switch S16.

While the gate is being lowered or raised, or, when it is in its lowered position, it may be struck by a vehicle. If the vehicle is approaching the crossing, the gate will be broken. If it is leaving the crossing, the gate will be horizontally turned. After the gate has been turned, it may be desirable to prevent it from rising before it returns to its normal position across the highway. To do this, means are provided, in accordance with the present invention, for energizing the relay R as soon as the gate leaves its normal vertical area or plane of operation and for keeping the relay energized so long as the gate remains out of its normal plane. In the construction illustrated, such means comprises a normally open switch 17 pivotally mounted on the head through the agency of a switch supporting frame 18 which is pivotally secured to a bracket 10*a* that depends from the underside of U-shaped bracket 10. The switch frame 18 tends, by gravity, to rock to a switch closing position but normally is prevented from rocking by having its heavy end rest loosely on a fixed part 19 of the standard. However, as soon as the head begins to turn, it is elevated by the rollers and this elevating movement raises the switch frame 18 relatively to the fixed rest 19 sufficiently to permit the frame to rock to the switch closing position. The switch 17, being carried by the head, naturally remains in its closed position as long as the head remains out of its normal position. Since this switch functions only to shortcircuit or shunt out the interlocking relay switch 12, which controls the energization of relay R, it becomes apparent that relay R will be energized and remain energized as long as the head is out of its normal position. With the relay energized, the gate operating mechanism will be operated to lower the gate, if it be out of the lowered position, and, to hold it in such position until the head returns to and drops in its normal position.

After the vehicle, which turns the gate, has released it, it is desirable to return the gate. In further accordance with my invention this is accomplished by securing a piston and cylinder between and respectively to the standard and head, connecting its chambers to each other through a pressure relief valve and to the suction and pressure sides of a motor driven pump in such manner that the pump tends to operate piston and cylinder in a gate return direction, and operating the pump while the head remains out of the normal position. To this end a return cylinder 20 is fixedly secured to the underside of the head's U-shaped bracket 10 so as to rotate with the head. Its piston 21 is connected through a flexible chain 22, which extends around a guide member 23, in the form of a rotatable gear mounted on and carried by head bracket 10, to a connector 24, the latter being pivotally mounted on a fixed centrally located standard part 25. In this manner, when the gate is turned outwardly from its normal position, the piston is held stationary and the cylinder moved clockwise in the arrangement illustrated. In moving clockwise, the size of its gate turning chamber

26 (on the left) is increased and that of the gate returning chamber 27 (on the right) is decreased while, in returning or moving counterclockwise, such action is reversed.

The gate turning chamber 26 and returning chamber 27 may be connected to an oil system independent of the system employed for the operating mechanism but preferably are connected respectively to the suction and pressure sides of the operating system and thus connected to each other through the pressure relief valve 9. Thus in turning outwardly oil is forced from the return chamber into the pressure side and drawn into the turn chamber from the suction side. In returning, such action must be reversed; hence, it is necessary to close the motor circuit since it will normally be opened in the down position by the down limit switch 16. Consequently, another normally open switch 28 is mounted on the pivotal frame 18. This switch is arranged to close and open in the same manner as switch 17 and, when closed, to shunt out the down limit switch 16. With this arrangement, as soon as the head turns, switches 17 and 28 are operated to insure both the conditioning and the operation of the gate operating mechanism for the down operation. If the gate is out of the down position, it will be lowered and, if in the down position, it will be held down but an oil flow will be established through the relief valve 9. At the same time the return chamber 27 will also force oil into the pressure side of the oil system against the pressure of the pump and this oil will likewise flow through the relief valve 9 to the suction side of the system from which some oil will pass into the turn chamber. This action continues as long as the gate turns outwardly. When it reaches the end of its outward movement, the oil pressure in supply side 7 of operating mechanism oil system becomes effective to force oil into the return chamber 27 and draw oil out of the turn chamber 26 to effect the gate return movement. At its normal position, the head drops from its elevated position to open both switches 17 and 28 and thereby restore the control system for normal operation.

The speed at which the return mechanism returns the gate will be determined by the capacity of the pump and the size of the return cylinder. It is easily possible to make the return cylinder of a size large enough to insure a very low rate of return speed or at any smaller size to provide a correspondingly higher rate of speed, as may be desired.

It will be understood that the gate after reaching the up position will be locked therein as long as the relay R remains de-energized and that, after it has reached the down position, it will again be locked as long as the relay R remains energized. With this character of operation, it may be pointed out that the return mechanism can be made further to accomplish an important result, when the gate is in the down position, simply by counter-weighting the gate, as indicated by dotted lines 29 in Figure 3, so that it tends to rise by gravity. Now, with the gate lowered, should a failure of some character, such as power failure which de-energizes the control system, cause the valve to return to its gate raising position, the counterweight will exert a pressure in the suction side of the oil system which tends to turn the gate, a result prevented by the roller recesses. The return cylinder will therefore remain stationary but the counterweight pressure will be effective to move the piston to the right and thereby permit a flow of oil from the gate lowering chamber of the jack to the turn chamber 26 of the return mechanism and from the return chamber 27 of the latter to the gate raising chamber of the jack, a flow which causes the gate to rise. This flow is not effective to cause the gate to rise completely to the up position but it will cause it to rise to a cautionary position wherein it is high enough to clear the highway and low enough to attract attention and thereby act as a warning signal.

Referring now to the relay solenoid, which has been hereinbefore designated generally by the numeral 11, as in Figures 1 and 2, it is noted that such device is shown in detail in Figures 9 to 13 inclusive. As shown, its relay R comprises a relay coil 30, a magnetic core 31 of inverted U-shape, and an armature 32, movable between inoperative or gate up and operative or gate down positions, while its solenoid S comprises a pair of coils 33 arranged between upper and lower cross members 34, 35 of magnetic and non-magnetic character, respectively, and solenoid plungers 36 for each coil, each plunger being movable, through an opening in the lower non-magnetic cross member 35 of the solenoid, between inoperative or gate up and operative or gate down positions, and being mechanically connected to each other by a magnetic cross bar 37.

The relay and solenoid are held as an unit in fixed space relation by brass securing bolts 38 extending in pairs on each side of the unit from the relay core 31 through the solenoid upper and lower cross members 34 and 35, while the relay core 31 is spaced from the solenoid cross member 34 by brass spacers 38*a* placed over the securing bolts 38. The relay core 31, solenoid stationary cross members 34 and 35, bolts 38 and spacers 38*a* thus cooperate to provide a fixed or unitary frame in which the magnetic circuit of the relay and solenoid are independent of each other.

The movement of the relay armature 32 is used to effect the operation of the solenoid circuit closing switch R13 and to this end such switch is pivotally mounted on the frame of the relay solenoid and actuated through a link 39 which is mechanically connected at its opposite ends to the switch R13 and the relay armature 32. With the solenoid coils energized, their plungers 36 will move upwardly and such movement may be utilized to operate the valve V from the gate up to the gate down position by connecting the valve to the solenoid plunger cross bar 37.

To hold the valve in the gate down position, a holding armature 40 is arranged between the relay core 31 and the solenoid upper cross member 34 and mechanically connected to the solenoid plungers 36 for movement upwardly against the relay core when the solenoid is energized. Accordingly the holding armature 40 is connected to the plunger cross bar 37 by non-magnetic arms 41 at the outer sides of the solenoid coils. Thus the solenoid plungers 36 together with their cross member 37, arms 41 and holding armature 40, form a movable carriage which moves upwardly, when the solenoid is energized, until carriage holding armature 40 strikes relay core 31. The latter thereafter holds the carriage in its upper position as long as the relay remain energized. With this arrangement the solenoid can be de-energized immediately after its operation. Consequently the solenoid switch S14 and one or more other switches, as may be desired, such as the motor up circuit switch S15 and the motor

down circuit switch S16, are pivotally mounted on the fixed frame of the relay solenoid and operated by the movement of the solenoid carriage through an arm 42 which connects the carriage to the switches. It will be obvious that, when the relay coil 30 is deenergized, its armature and the armature-operated switch, as well as the solenoid carriage and the carriage-operated switches, will return to their normal positions. The return of the carriage is made positive by using springs 43 between the carriage and the frame which springs are conveniently placed over the carriage arms 41, between frame part 34 and carriage part 37.

The term "jacktype", as applied herein to crossing gates, is intended to define a pivoted gate structure in which the gate arm is moved, between its operative and inoperative positions, by a fluid-operated piston-cylinder device or jack.

Having described my invention, I claim:

1. A crossing gate for protecting a track block comprising a horizontally swingable gate normally movable vertically between up and down positions, an operating mechanism to move said gate vertically, a control system having a relay which, when energized and de-energized, renders the system operable to effect the operation of said operating mechanism for gate movements respectively in opposite direction, and means operative when the gate is horizontally turned while lowered to condition the relay for the gate down operation only.

2. A crossing gate for protecting a track block comprising a horizontally swingable gate normally movable vertically between up and down positions, operating mechanism for moving the gate up and down, said mechanism including a valve operable in one position to condition the operating mechanism for the down movement and in its other position for the up movement of the gate, a system for controlling the operating mechanism, said system including a relay solenoid operable when the relay is energized to move the valve to one of its positions and, when de-energized, to move the valve to the other position and means operative when the gate is horizontally turned while lowered to condition the relay for the valve down position only.

3. A crossing gate for protecting a track block comprising a horizontally swingable gate normally movable vertically between up and down positions, operating mechanism for moving the gate up and down, said mechanism including a valve operable in one position to condition the operating mechanism for the down movement and in its other position for the up movement of the gate, a control system having a relay operable when the relay is energized to effect the down operation of the gate operating mechanism and, when the relay is de-energized, to effect the up operation, a normally open switch adapted when closed to cause said relay to be energized, and means for closing said switch when the gate is horizontally turned while lowered.

4. A crossing gate for protecting a track block comprising a standard, a normally stationary horizontally turnable head, a gate carried by said head for vertical operation between up and down positions, means for moving said gate up and down, a piston cylinder connected between head and standard, and fluid-pressure operated means operative after the head is horizontally turned to operate said piston cylinder to return said head to its normal position occupied when the gate is down and extends across the highway.

5. A crossing gate for protecting a track block comprising a standard, a normally stationary horizontally turnable head, a gate carried by said head for vertical operation between up and down positions, means for moving said gate up and down, a return mechanism having a piston part and a cylinder part connected between head and standard, one part being stationary and the other movable with the head when the latter is horizontally turned, and fluid-pressure operated means operative after the head is turned to return said movable part to its normal position occupied when the gate is down and extends across the highway and thereby to return the head.

6. A crossing gate for protecting a track block comprising a standard, a normally stationary horizontally turnable head, a gate carried by said head for vertical operation between up and down positions, means for moving said gate up and down, a gate return mechanism having a piston part and a cylinder part connected between and respectively secured to said head and standard, one part being stationary and the other part being movable with the head when it is horizontally turned, and a source of fluid pressure, said cylinder having a return fluid chamber connected to said source of fluid pressure to effect the return of said head after it has been horizontally turned.

7. A crossing gate for protecting a track block comprising a standard, a normally stationary horizontally turnable head, a gate carried by said head for vertical operation between up and down positions, means for moving said gate up and down, a gate return mechanism having a piston part and a cylinder part connected between and respectively secured to said head and standard, one part being stationary and the other part being movable with the head when it is horizontally turned, and a pump having its pressure side connected to said cylinder and adapted when operated to urge said movable return mechanism part in the return direction of the head, and means for maintaining the pump in operation when the head is turned.

8. A crossing gate for protecting a track block comprising a standard, a normally stationary horizontally turnable head, a gate carried by said head for vertical operation between up and down positions, a jack for operating the gate up and down, a jack operating system including a reversing valve and a motor driven pump connected through said valve to said jack, a relief valve connecting supply side of pump to suction side thereof, a gate return mechanism having a piston part and a cylinder part connected between and respectively secured to said head and standard, one part being stationary and the other movable with the head when the latter is horizontally turned, said cylinder having turn and return chambers respectively connected to suction and pressure sides of said pump, and means for maintaining the pump in operation when the head is turned.

9. A crossing gate for protecting a track block comprising a standard, a gate supported by said standard for vertical operation between up and down positions, a motor actuated operating mechanism for moving the gate up and down, an electrical control system therefor, and means operative upon a motor failure occurring when the operating mechanism is conditioned to effect movement of the gate from lowered position to raised position to move said gate from said lowered position toward said raised position to an intermediate position.

10. A crossing gate for protecting a track block comprising a standard, a gate supported by said standard for vertical operation between up and down positions, a motor actuated operating mechanism for moving the gate up and down, an electrical control system therefor, and counterweight means operative upon a motor failure occurring when the operating mechanism is conditioned for movement of the gate from lowered position to raised position, to move said gate by gravity from said lowered position toward said raised position to an intermediate position.

11. A crossing gate for protecting a track block comprising: a horizontally swingable gate normally movable vertically between up and down positions; an operating mechanism to lower and raise said gate between said positions; and a system electrically controlling the operation of the operating mechanism; said system including means operative, when the gate is horizontally turned while lowered, to render the control system inoperable for effecting the gate raising operation of said operating mechanism.

12. A crossing gate for protecting a track block comprising: a horizontally swingable gate normally movable vertically between up and down positions; an operating mechanism to lower and raise said gate between said positions; a system electrically controlling the operation of said operating mechanism; and means operative, when the gate is horizontally turned while lowered, to render the control system inoperable for conditioning the gate operating mechanism for the gate raising operation.

13. A crossing gate for protecting a track block comprising: a horizontally swingable gate normally movable in a vertical plane between up and down positions; an operating mechanism to raise and lower said gate between said positions; a system for electrically controlling the operation of said operating mechanism; and means operative, when and as long as the gate is both lowered and horizontally swung out of said vertical plane, to render the control system inoperable for effecting the gate raising operation of said operating mechanism.

14. A crossing gate for protecting a track block comprising: a horizontally swingable gate normally movable in a vertical plane between up and down positions; an operating mechanism to raise and lower said gate between said positions; a system for electrically controlling the operation of said operating mechanism; and means operative, when and as long as the gate is both lowered and horizontally swung out of said vertical plane, to render the control system operable only for effecting the gate lowering operation of said operating mechanism.

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