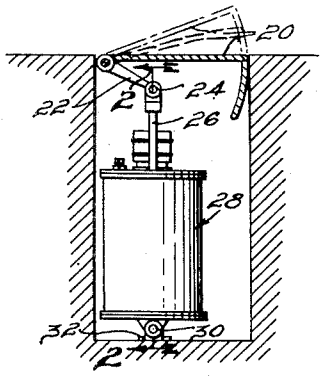
Jan. 16, 1940. J. M. EVANS 2,187,513

HYDRAULIC OPERATING DEVICE

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FIG. 1.



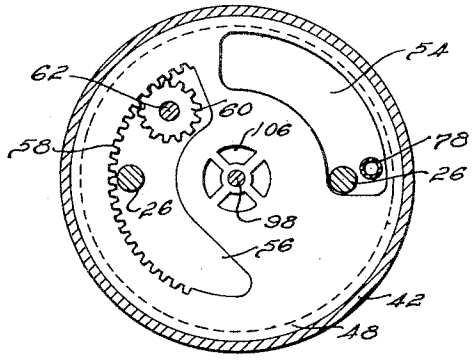


FIG. 3.

FIG. 2.

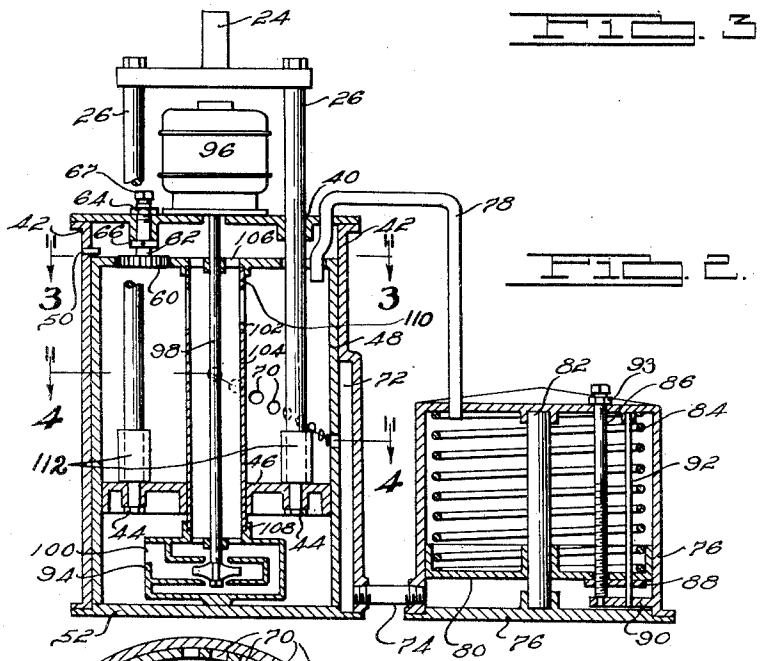
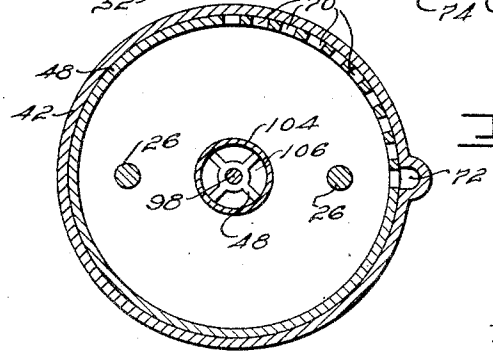


FIG. 4.



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HYDRAULIC OPERATING DEVICE

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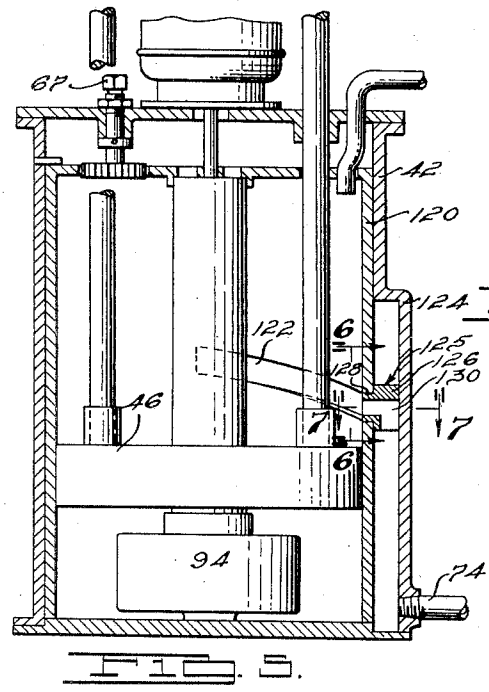


FIG. 5.

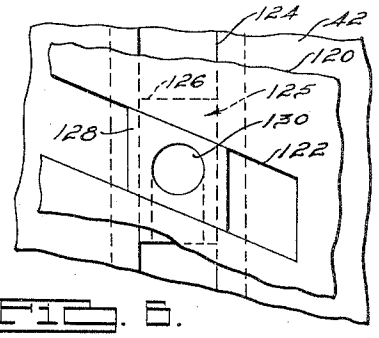


FIG. 6.

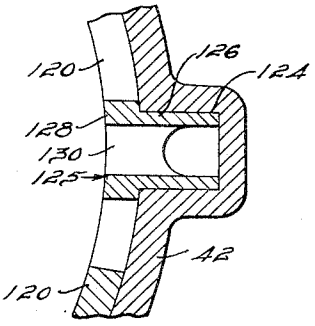


FIG. 7.

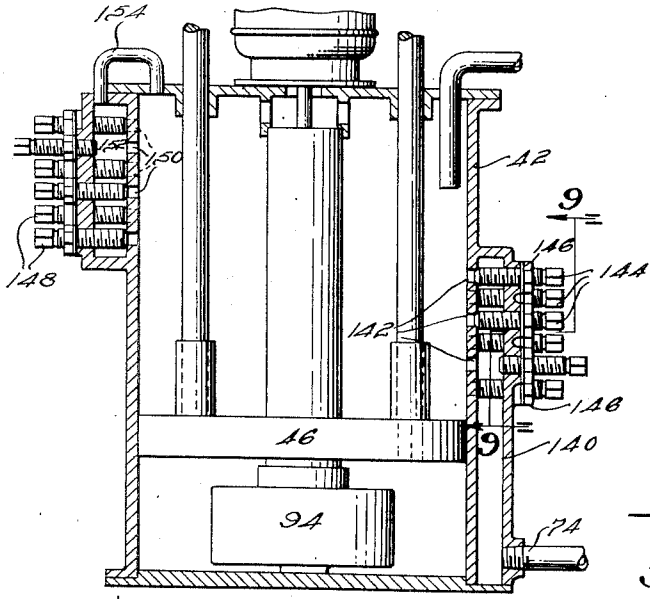


FIG. 8.

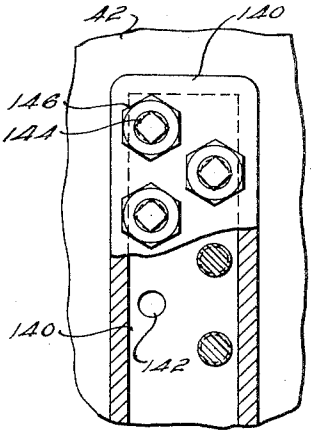


FIG. 9.

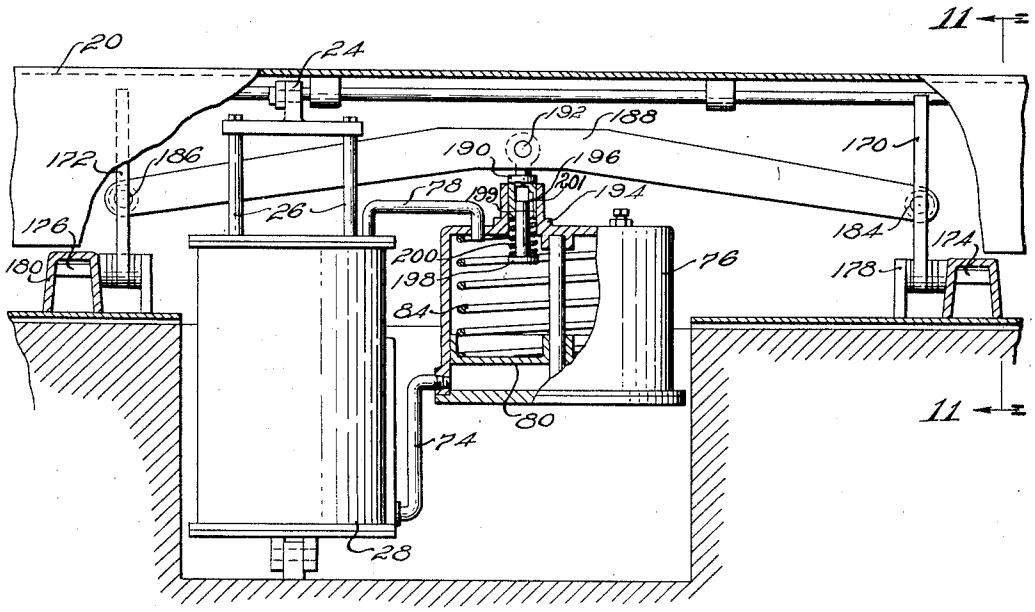
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HYDRAULIC OPERATING DEVICE

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Fig. 10.



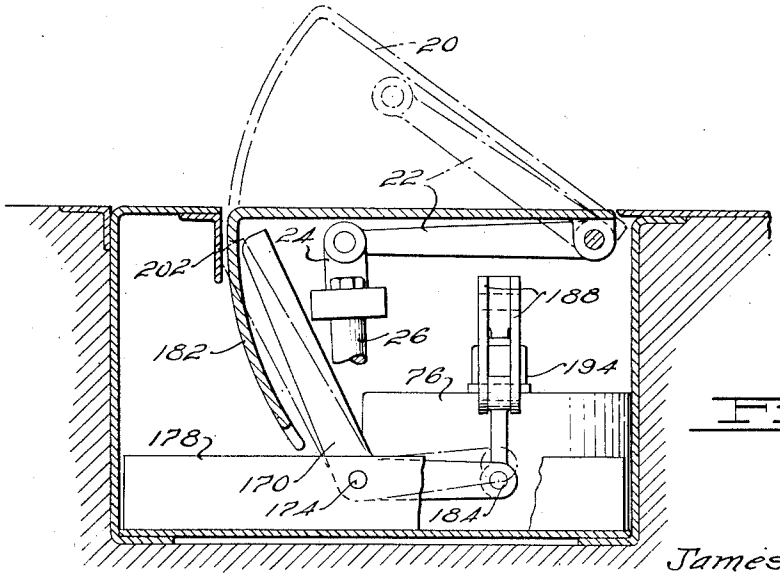


Fig. 11.

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UNITED STATES PATENT OFFICE

2,187,513

HYDRAULIC OPERATING DEVICE

James Moore Evans, Detroit, Mich., assignor, by mesne assignments, to Grade Crossing Guard Corporation, Memphis, Tenn., a corporation of Tennessee

Application August 2, 1935, Serial No. 34,321

4 Claims. (Cl. 60—52)

The present invention relates to protective devices for use at road crossings and the like, and particularly to hydraulic operating devices for controlling the operation of such protective devices, as well as of other devices.

It is an object of the present invention to provide a hydraulic ram in which the movement of the ram may be automatically retarded or interrupted at any adjustably predetermined point in the path of movement thereof.

It is also an object of the present invention to provide a hydraulic ram in which the duration of the interruption of the ram movement may be conveniently adjusted.

It is also an object of the present invention to provide a hydraulic ram embodying an auxiliary chamber to control the interruption of the ram movement at the intermediate stage.

It is also an object of the present invention to provide a hydraulic ram of the above character embodying an intermediate adjustable sleeve to render the auxiliary chamber effective and control the point in the path of movement of the ram at which the retardation or interruption in the movement thereof occurs.

It is also an object of the present invention to provide a protective device embodying main and auxiliary hydraulic actuating rams, in which the movement of the auxiliary ram piston automatically actuates a holding device to positively retain the protective device in an extended or operative position.

Other objects and advantages of the present invention appear in the following description and in the appended claims.

In the drawings:

Figure 1 is a schematic view of a crossing barrier and operating mechanism therefor embodying the present invention;

Fig. 2 is a view in vertical section, taken on the line 2—2 of Fig. 1;

Fig. 3 is a view in horizontal section of an adjusting member, taken on the line 3—3 of Fig. 2;

Fig. 4 is a view in horizontal section of the adjusting sleeve, taken on the line 4—4 of Fig. 2;

Fig. 5 is a view in vertical section of a modified embodiment of the present invention;

Fig. 6 is a fragmentary view in side elevation, taken along the line 6—6 of Fig. 5;

Fig. 7 is a fragmentary view in horizontal section, taken along the line 7—7 of Fig. 5;

Fig. 8 is a view in vertical section of a second modification of the present invention;

Fig. 9 is a fragmentary view in vertical section, taken along the line 9—9 of Fig. 8;

Fig. 10 is a view in elevation of a hydraulically actuated protective device, embodying a mechanical holding means to retain the protective device in an extended or operative position; and

Fig. 11 is a view in vertical section taken along the line 11—11 of Fig. 10.

As described more in detail hereinafter, the arrangement comprises generally a crossing barrier, which normally occupies the illustrated retracted position, and is connected to the push rod of a hydraulic ram for actuation thereby. The ram may be actuated manually or automatically, and moves the barrier through an initial warning movement, retards or interrupts its motion temporarily, and finally moves it to a final extended position. Thereafter, the ram may be actuated to return the barrier to the initial position.

It will be understood that the illustrated form of barrier is illustrative only, and that any suitable form may be substituted therefor and arranged for actuation by the ram in the practice of the present invention. The illustrated form is similar to that disclosed in the co-pending application of Glenn W. Goodman, deceased, Serial No. 744,722, filed September 18, 1934, for reissue of Patent No. 1,878,234, and assigned to the same assignee as the present application, and comprises a member pivotally supported in an embedded box, which may be suitably positioned in a roadway.

The hydraulic ram of the present invention embodies many features in common with the hydraulic ram disclosed and claimed in the co-pending application, now abandoned, filed jointly by the present applicant and S. M. Nampa, Serial No. 34,320, filed August 2, 1935, and assigned to the same assignee as the present invention. The hydraulic ram disclosed in the latter application embodies mechanism to effect a hesitation in the movement thereof during either the forward or return stroke. Mechanism is also provided to enable the ram to absorb excessive overloads, and to relieve the actuating pressure when the ram is at the upper limit of its travel.

In accordance with the present invention, it is considered desirable to provide for the complete interruption of the movement of the hydraulic ram at any desired intermediate point in its path, although the illustrated mechanism may also be used to effect merely a retardation in the movement. The arrangement is also such that the duration of the retardation or interruption in the

ram movement may be conveniently adjusted. In accordance with one modification of the present invention, the hydraulic ram is provided with an intermediate sleeve adjustably positioned to expose a relief port at an intermediate stage of the ram movement. As will be apparent from further description, the size of the port thus exposed determines whether the ram movement shall be merely retarded or shall be entirely interrupted. The exposed port leads to an auxiliary chamber, embodying a movable piston, and normally filled to the normal level thereof. Upon the auxiliarly chamber being filled with the actuating fluid through the relief port, the original rate of ram movement is resumed.

In accordance with a modified embodiment of the present invention, a plurality of independently operable valves are provided to expose a relief port at a predetermined point in the path of movement of the ram. The ports thus exposed lead to the above described auxiliary chamber, which functions as above mentioned to effect the resumption of the original rate of movement.

The auxiliary chamber embodies a spring biased piston, the force of the biasing spring being less than the normal load on the ram. During the period of retarded or interrupted movement, the auxiliary piston is moved against the force of the spring, which serves to restore the piston to an original position upon completion of an operating cycle. The normal position of the piston is adjustable, thus modifying the volume to be filled, and determining the length of the period of retarded or interrupted motion.

In further accordance with the present invention, the piston is arranged to provide holding or retaining mechanism which becomes effective during the extending movement of the guard to positively retain it in the extended position. Preferably, however, and as illustrated, the holding mechanism is ineffective during the initial movement of the guard, so that the latter may be forcibly pushed back against the force of the actuating mechanism, in response, for example, to the passage over it of a vehicle.

In the form illustrated, the holding mechanism comprises a mechanical interlock, composed of a pair of spaced pivotally mounted arms, which may be swung into a position in which they are effective to block and prevent downward and retracing movement of the barrier. The arms are resiliently connected, through a spring, to a member which is actuated by the piston of the auxiliary or retarding cylinders, mentioned above. When such auxiliary piston reaches the upper movement of its stroke, the plunger is engaged thereby and moved upwardly, tending to force the arms into blocking position. This movement is prevented at the time by the formation of the guard itself. At the conclusion of the guard movement, however, the guard moves past the end of the arms, permitting the latter to swing to blocking position under the influence of the previously mentioned spring. The directions of motion of the parts are such that after the arms reach a blocking position, any downward movement exerted thereon by the guard tends to force the arms to a further blocking position, so that the spring and associated parts are required to serve only the function of moving the arms to blocking position.

Referring in detail to Figs. 1 through 4, barrier **20**, which normally occupies the illustrated retracted position, is pivotally connected through a crank **22** and clevis **24** to the push rods **26** of a hydraulic ram designated generally **28**. Ram **28** is pivotally supported by a lower clevis **30** upon a suitably embedded stationary support **32**. As will be understood, upward movement of push rods **26** moves barrier **20** from the full line position to the extreme dotted line position, and, as hereinafter described, the movement thereof may be temporarily interrupted at an intermediate position indicated by the intermediate dotted line.

Referring to Figs. 2, 3 and 4, the push rods **26** extend through openings **40** formed in the top surface of cylinder **42**, and are secured by nuts **44** to a piston head **46**, which is slidably fiitted into an inner sleeve **48**. Sleeve **48** is of cylindrical cross-section and is rotatably fitted in cylinder **42**. As illustrated, a lug **50** prevents upward movement of sleeve **48**, and the lower end thereof bears against the base plate **52** of cylinder **42**.

As shown in Fig. 3, the upper surface of sleeve **48** is provided with an arcuate slot **54**, through which one of the push rods **26** passes, and with an enlarged arcuate opening **56**, one side of which is formed as an arcuate rack **58**. A pinion **60**, fixed on a trunnion **62**, meshes with rack **58** and serves to rotate sleeve **48** within cylinder **42** to adjust the hesitation point of piston **46**, as described in more detail below. Trunnion **62** passes through an opening formed in the upper surface of cylinder **42** and is normally fixed therein between a lock nut **64** and a collar **66**. As will be understood, by relieving lock nut **64**, trunnion **62** may be turned by means of the head **67**, rotating gear **60** and, consequently, rotating sleeve **48** within cylinder **42**.

As best shown in Figs. 2 and 4, the side wall of sleeve **48** is provided with a series of openings **70**, which are angularly arranged, and may, upon rotation of sleeve **48**, be moved into or out of registration with a relief column **72** formed at one side of cylinder **42**.

Column **72** communicates through nipple **74** with the interior of an auxiliary chamber **76**, which serves to determine the duration in the hesitation of the movement of piston head **46**. Chamber **76** is normally entirely filled with fluid, and communicates with the upper portion of chamber **42** through a pipe **78**, which extends slightly below the normal fluid level, in sleeve **48**. Piston **80** is guided on a column **82** in chamber **76**, and is biased to a normal lower position by means of a coil spring **84**, seated between the upper surface of chamber **76** and piston **80**, but may be moved upwardly within chamber **76** by rotation of a traveling screw **86**. Screw **86** passes through an opening formed in the upper surface of chamber **76**, is threaded through a plate **88**, and is freely supported in a base member **90** secured to the chamber **76**. Rotation of screws **86** in one direction draws plate **88** upwardly, the movement thereof being additionally guided by rod **92**, which action forces piston head **80** upwardly within chamber **76**. Rotation of screw **86** in the opposite direction causes plate **88** to move downwardly, in which event piston head **80** also moves downwardly under the influence of spring **84**. Screw **86** may be locked in position by a lock nut **93**.

Pump **94**, which may be of any suitable type effective to force a fluid in one direction, but adapted when idle to permit a free passage of fluid in the opposite direction, and illustrated as of the radial bladed centrifugal type, is driven by

motor 96 through shaft 98, and communicates with the lower portion of cylinder 46 through port 100, and with the upper portion thereof through side ports 102 formed in an inner sleeve 104. As shown, sleeve 104 is tightly fitted within an annular recess 108 formed in the housing of the pump 94, passes through an opening formed in piston 46, and is somewhat freely seated in a recess 110 formed in the under side of the upper end wall of sleeve 48. A plurality of ports 106 provide communication between sleeve 104 and the interior of the pump housing. As will be understood, suitable packing may be interposed between piston 46 and sleeve 104, as well as between sleeve 104 and sleeve 48. Similarly, suitable packing may be interposed between piston head 46 and sleeve 48.

Resilient sleeves 112, secured to push rods 26 engage the upper end wall of sleeve 48 to provide a limit stop for piston 46. The upper end wall of sleeve 48 also serves as a baffle to prevent splashing and foaming of the fluid.

With reference to the operation of the hydraulic ram as a whole, motor 96 may be placed in operation to effect an upward movement of piston head 46. The starting of motor 96 may be effected in any suitable manner, depending upon the use to which the mechanism is to be placed. For example, in connection with the use of the mechanism to actuate crossing guard mechanism as shown in Fig. 1, motor 96 may desirably be automatically placed in operation upon the approach of a vehicle to the associated crossing. The mechanism for initiating the operation of motor 96 forms no part of the present invention, and accordingly has not been illustrated.

Upon being started, motor 96 drives pump 94, the direction of operation thereof being immaterial in view of the illustrated pump construction, causing the latter to draw fluid downwardly through sleeve 104 into the region beneath piston 46. As will be understood, the pressure thus developed is determined by the pump and motor characteristics. In response to the pressure thus developed, piston 46 moves upwardly, carrying push rods 26 with it, and correspondingly actuating the mechanism connected thereto. In the course of the upward movement of piston 46 within sleeve 48, the lower edge of piston 46 sequentially passes above the series of openings 70 formed in the side of sleeve 48.

When piston 46 exposes the particular opening 70 in registration with column 72, a part of the fluid pressure is diverted, and forces piston 80 upwardly, the force of spring 84 being less than the normal load on push rods 26. As will be understood, dependent upon the size of openings 70, column 72 and nipple 74, this action may be caused to either retard or entirely interrupt the upward motion of piston 46. It will also be understood that the point in the movement of piston 46 at which the retardation or interruption of the movement thereof occurs, is determined in accordance with the adjustment of sleeve 48 within cylinder 42, and that the duration of the retardation or interruption is determined by the position of piston 80 within chamber 76, and by the characteristics of spring 84. Both of these determining factors are adjustable, as above described, by members 67 and 86.

The original rate of movement of piston 46 is resumed when piston 80 reaches its upper limit of travel. As will be understood, the upward movement of piston 46 may be limited either by the character of the mechanism to which push rods 26 are connected, or by limit stop mechanism positioned within the ram. As illustrated in Fig. 2, members 112 engage the upper surface of sleeve 48 and interrupt further movement of piston 46 upon its approach to the upper limit of its stroke.

When piston 46 reaches the upper limit of its travel, pump 94 continues to operate without causing further movement of any of the moving parts, motor 96 and pump 94 being preferably designed in any well known manner to operate under these conditions.

In the illustrated embodiment of the present invention, the return of piston 46 to the normal position is effected by gravity, upon interrupting the operation of pump 94 and motor 96. During this return movement, as will be understood, the fluid circulates from the region beneath piston 46 through pump 94, sleeve 104 and into the upper portion of sleeve 48. Spring 84 forces piston 80 downwardly somewhat rapidly to the normal position thereof in engagement with plate 88. During this movement, the fluid in the lower part of chamber 76 is forced back into sleeve 48 through column 72 and fluid passes through pipe 78 from sleeve 48 into the upper portion of chamber 76.

The modification illustrated in Fig. 5 embodies the same operating characteristics as described in connection with Figs. 1 through 4, and with the exception of the inner sleeve and relief column construction, may embody identical parts. Identical parts, accordingly, are given the same reference characters in Figs. 5, 6 and 7 as in Figs. 1 through 4.

Referring particularly to Figs. 5, 6 and 7, inner sleeve 120 is provided with an angular slot 122 cut into the side wall thereof. A cooperating column 124 of substantially rectangular cross-section is formed at the side of cylinder 42, and a follower 125 having one portion 126 slidably fitted within column 124 and a second portion 128 slidably fitted within slot 122, is cored out to provide a port 130 and permits passage of fluid between the interior of sleeve 120 and the interior of column 124. Rotation of sleeve 120 within cylinder 42 in response to rotation of screw 67, as previously described, causes slot 122 to move with respect to portion 128, raising or lowering the latter in column 124.

As will be understood, when piston 46 exposes the portion of slot 122 which is in communication with relief column 124, the fluid pressure is diverted through the latter, resulting in the above described interruption or hesitation in the movement of piston 46. In all other respects, the operation of the modification illustrated in Figs. 5, 6 and 7 is as previously described.

In accordance with the modification illustrated in Figs. 8 and 9, the previously described inner sleeve may be dispensed with and communication between the cylinder and the release column effected through a series of selectively adjustable valves. In Figs. 8 and 9, communication is provided between the interior of cylinder 42 and release column 140 through a series of ports 142 which extend through the side wall of cylinder 42 at rather closely spaced points. A series of needle valves 144, provided with lock nuts 146, respectively, are threaded through the outer wall of column 140 and may be selectively turned to open or close the associated ports 142. As will be understood, the staggered relationship of valves 144 permits a rather close adjustment of the point at which the hesitation of piston 46 is effected. In accordance with this modification also, depending upon the size of ports 142, and the de-

gree to which such ports are opened, the movement of piston 46 may either be retarded or entirely interrupted, as described in connection with the other embodiment. Similarly, by appropriately opening several of the valves 144, a progressive decrease in the speed of piston 46 may be effected.

A corresponding series of valves 148 is provided to selectively control a series of by-pass ports 150 which lead from the interior of cylinder 42 to a column 152. Column 152 is connected to the interior of cylinder 42 by a by-pass pipe 154. With this arrangement, and depending upon the particular valve or valves 148 which occupy the open position, a by-pass line around piston 46 is completed as the latter approaches the upper end of cylinder 42. The by-pass thus provided at an adjustable point in the final movements of piston 46, relieves the actuating pressure thereon and consequently interrupts the upward movement thereof.

In all other respects, the modification illustrated in Figs. 8 and 9 may be as described in connection with Figs. 1 to 4, and a more detailed description thereof, as well as the operation, is considered unnecessary.

The modification shown in Figs. 10 and 11, which includes the positive holding mechanism, as above described in a general way, may embody ram mechanism in all respects as described in connection with Figs. 1 through 9. In addition, two crank arms 170 and 172 are pivotally supported by pins 174 and 176 in stationary standards 178 and 180 respectively. The outer end of each of the arms 170 and 172 normally occupies a position adjacent the apron portion 182 which forms a part of the guard 20.

The other ends of cranks 170 and 172 are pivotally secured to trunnions 184 and 186, which are formed at opposite ends of a cross bar 188. Bar 188 is pivotally connected at substantially its mid point to an arm 190 by a pin 192. Arm 190 extends into a collar 194 formed at the upper surface of the auxiliary cylinder 76. The lower part of arm 190 is cored out to receive the upwardly extending shank 196 of plunger 198. A spring 200 is seated between the end of arm 190 and a shoulder formed on plunger 198. Plunger 198 extends into the interior of auxiliary cylinder 76, in the path of the auxiliary piston 80. A key 199 on plunger 198 rides in a blind slot 201 formed in arm 190, and prevents plunger 198 from falling out of the latter.

In operation, the upward movement of push rods 26 associated with the main ram 28, swings the main crank arm 22 in a clockwise direction as viewed in Fig. 11, effecting an extending movement of the guard 20. At an adjustably variable point in the path of travel of guard 20, as described in detail with reference to Figs. 1 through 9, the by-pass line 74 is opened and a portion of the actuating fluid is diverted into auxiliary cylinder 76, causing piston 80 to rise therein. This action, as previously described, effects either a reduction in the rate of travel of guard 20 or completely interrupts the movement thereof, until auxiliary piston 80 reaches the upper limit of its stroke. At this time the original rate of movement of guard 20 is continued.

Shortly in advance of the arrival of auxiliary piston 80 at its limiting position, the upper surface thereof engages plunger 198, forcing it upwardly within arm 190 against the force of the spring 200. The force thus transmitted through spring 200 tends to move cross arm 188 vertically as viewed in Fig. 10 and to correspondingly rotate cranks 170 and 172 in a counterclockwise direction as viewed in Fig. 11. An initial such movement, however, brings the outer ends of cranks 170 and 172 into engagement with the inner surface of apron 182. At the conclusion of the extending movement of guard 20, the lower end of apron 182 passes from the outer ends of cranks 170 and 172, releasing these members, which accordingly rotate in a counterclockwise direction, as viewed in Fig. 11 to a position beneath the end of apron 182, and thus effectively block any downward movement thereof.

It will be noted that due to the relative positioning between the ends of the cranks 170 and 172 when in locking position, and the pivot points therefor, any downward force exerted thereon by guard 20 tends to cause further counterclockwise rotation of the crank arms. With this relationship, accordingly, the cross arm 188 and connected parts are required to supply only the force required to swing the crank arms to locking position, and when in that position, they are supported against the stationary parts, illustrated as comprising the downwardly extending member 202 associated with the receptacle within which the barrier is positioned. It will also be noted that the locking mechanism comprising the crank arms is not rendered effective until the barrier reaches a final position so that, if necessary, a temporary retracting movement of the guard, against the force of main actuating mechanism, is possible during the intermediate movements thereof.

A retracting or return movement of the barrier is effected as described in connection with Figs. 1 through 9, by interrupting the pumping or other actuating mechanism, in response to which action the auxiliary piston 80 begins a return movement under the influence of its biasing spring 84, thus releasing the plunger 198 and permitting cross bar 188 to return to the illustrated position by gravity. This return movement swings cranks 170 and 172 in a clockwise direction as viewed in Fig. 11, out of the path of guard 20, at which time the latter returns to the illustrated full line position by gravity. At the beginning of the return movement of cranks 170 and 172, the apron 182 may be expected to be resting on the ends thereof. By properly proportioning the net gravitation force tending to retire arms 170 and 172, relative to the weight of the barrier, as by counter-weighting the latter, however, the arms may be caused to effectively release themselves from the apron.

Although the hydraulic ram mechanism of the present invention has been specifically described in connection with the control of a crossing guard, it will be evident that it may be applied to many other uses. It will also be evident that various modifications may be made in the form, number and arrangement of the operating parts of the guard, as well as of the hydraulic ram, within the spirit and scope of the present invention as defined in the appended claims.

What is claimed is:

1. In combination, a movable member, means for supporting said member for movement between a retracted and an extended position, actuating mechanism for said member including a fluid pressure operated ram having a cylinder, a piston supported within said cylinder, means for subjecting said piston to fluid pressure to

cause movement thereof within said cylinder, means for interrupting said movement at a predetermined point to thereby interrupt said member movement and for thereafter effecting a resumption of said movement comprising an auxiliary chamber, a piston supported within said chamber, means rendered effective by movement of said first mentioned piston for diverting a portion of said fluid pressure to cause movement of said auxiliary piston, and locking means rendered effective by movement of said auxiliary piston when the latter approaches the end of its stroke for positively holding said member in said extended position.

2. In a liquid pressure operated ram, the combination of a cylinder, a piston movably supported within said cylinder, means including a pump for transferring liquid from the cylinder space at one side of said piston to the cylinder space at the other side of said piston so as to cause movement of said piston in a predetermined direction in the cylinder, an auxiliary chamber, an auxiliary piston movably supported in said auxiliary chamber, means acting against one side of said auxiliary piston for biasing said auxiliary piston to a predetermined position in said auxiliary chamber, a liquid connection between said first-mentioned means and said auxiliary chamber for applying fluid pressure to the opposite side of said auxiliary piston, a liquid connection between the part of said auxiliary chamber at said one side of said auxiliary piston and that cylinder space from which the pump draws liquid, and valve means comprising a ported sleeve rotatably interposed between said piston and said cylinder for controlling said first mentioned liquid connection in accordance with the position of said piston.

3. In a liquid pressure operated ram, the combination of a cylinder, a piston movably supported within said cylinder, means including a pump for transferring liquid from the cylinder space at one side of said piston to the cylinder space at the other side of said piston so as to cause movement of said piston in a predetermined direction in the cylinder, an auxiliary chamber, an auxiliary piston movably supported in said auxiliary chamber, means acting against one side of said auxiliary piston for biasing said auxiliary piston to a predetermined position in said auxiliary chamber, a liquid connection between said first-mentioned means and said auxiliary chamber for applying liquid pressure to the opposite side of said auxiliary piston, a liquid connection between the part of said auxiliary chamber at said one side of said auxiliary piston and that cylinder space from which the pump draws liquid, and valve means for controlling said first mentioned liquid connection comprising a sleeve rotatably interposed between the piston and the cylinder and having a plurality of peripherally and longitudinally spaced ports therein disposed to be exposed by the piston as the latter moves in the cylinder, the cylinder having a port in communication with the first mentioned liquid connection disposed to register with said sleeve ports as determined by the rotative position of the sleeve.

4. In a fluid pressure operated ram, the combination of a cylinder, a piston movably supported within said cylinder, means including a pump for applying fluid pressure to the piston to cause movement thereof within the cylinder, and means for retarding the speed of movement of the piston for a predetermined interval when the piston reaches an intermediate point in its travel, comprising an auxiliary chamber, an auxiliary piston in said auxiliary chamber and having means associated therewith for urging it in one direction therein, a fluid connection for transferring fluid from said cylinder to said auxiliary chamber so as to urge said auxiliary piston in the opposite direction, and valve means for controlling said fluid connection comprising a valve rotatably interposed between the cylinder and piston having a plurality of peripherally and longitudinally spaced ports therein disposed to be exposed by movement of the piston, said cylinder having a port therein disposed to register with one of the sleeve ports in accordance with the rotative position of the valve.

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