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PROTECTIVE APPARATUS FOR HIGHWAY CROSSINGS

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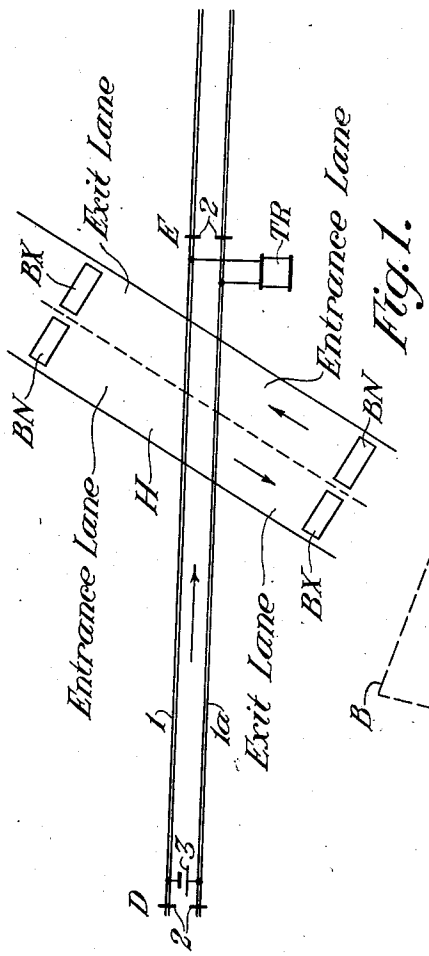


Fig. 1.

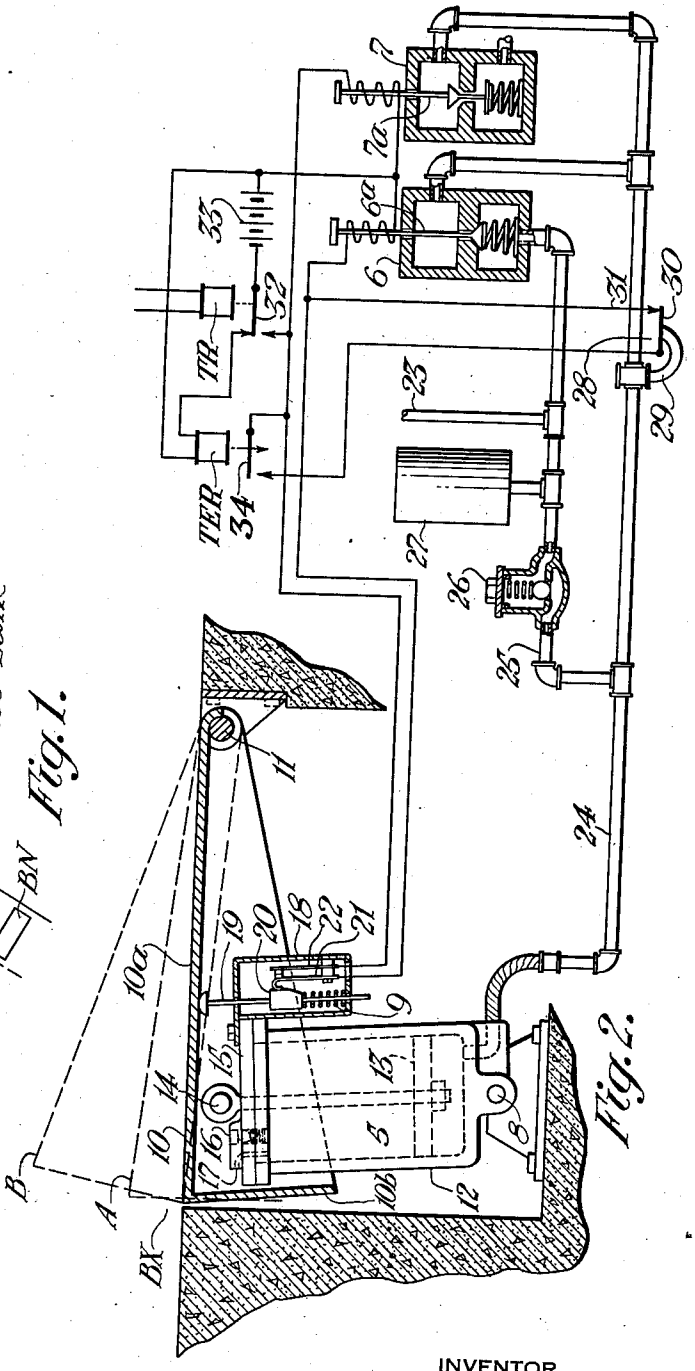


Fig. 2.

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PROTECTIVE APPARATUS FOR HIGHWAY CROSSINGS

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5 Claims. (Cl. 246—130)

My invention relates to protective apparatus for highway crossings, and has particular reference to protective apparatus of the barrier type wherein a barrier is arranged to be projected into or retracted from the path of a highway vehicle, as conditions warrant.

In a barrier type protective system, it is customary to provide barriers in the highway on opposite sides of a railway grade crossing and to arrange such barriers so as to bar not only the entrance lanes of the highway over which vehicles normally travel in approaching the highway but also the remainder of the highway so as to prevent the drivers from swerving their vehicles out of the entrance lanes and around the barriers. It often happens that the crossing is occupied by highway traffic when the barriers are caused to be projected, and since the full width of the highway is barred, such vehicles in leaving the intersection must drive over the barriers in their projected positions. To assist in this operation, the barriers are hinged at their ends nearest the crossing and are arranged so that when projected each constitutes a ramp over which a vehicle may drive. In addition, separate barriers are positioned in the entrance and exit lanes, the exit barriers being arranged to be readily depressed by a vehicle and incorporating means for delaying the movement of the barriers back to their projected positions after a vehicle passes over and depresses such a barrier.

In view of the foregoing and other important considerations, it is an object of my present invention to provide novel and improved electropneumatic operating means for an exit barrier.

Another object is the provision of an electropneumatic operating means for an exit barrier incorporating novel and improved means for slowing up the rebound of the barrier when a vehicle passes over and depresses such a barrier.

A further object is the provision of novel and improved means for making available two ranges of pressure for the electropneumatic operating means of a highway crossing barrier.

In practicing the invention, the above-mentioned and other important objects and characteristic features which will become readily apparent from the following description are attained by operating an exit barrier by a fluid pressure motor; by providing a pressure operated valve for at times limiting the pressure in the fluid motor to a relatively low value; by incorporating into the fluid motor a check inlet valve and a choke exhaust valve arranged to cause the motor to act as a snubber to restrict the rebound of the barrier when it is depressed; by providing an auxiliary branch line of relatively large size piping and including a reservoir between the source of fluid pressure and the motor; and by providing in the branch line intermediate the motor and reservoir a check valve arranged to pass fluid pressure from such motor to the branch line when the pressure in the motor builds up to a value above that of the source.

Other important features of my invention reside in the specific apparatus employed and in the arrangement thereof in a control system for a highway crossing barrier, and these features will be pointed out in detail in the following description and claims.

I shall describe one form of apparatus embodying my invention, and shall then point out the novel features thereof in claims.

In the accompanying drawing, Fig. 1 is a diagrammatic view illustrating the relation of highway crossing barriers to the highway portion of a railway-highway grade crossing. Fig. 2 is a diagrammatic view illustrating one form of apparatus embodying my invention. In each of the two views, similar reference characters have been employed to designate corresponding parts.

Referring first to Fig. 1, the reference characters 1 and 1*a* designate the track rails of a stretch of railway track over which traffic normally moves in the direction indicated by an arrow associated with the track or from left to right as viewed in the drawing. The rails 1 and 1*a* are divided by insulated joints 2 into a track section D—E provided with a track circuit comprising a battery 3 connected across the rails at one end D and a track relay TR connected across the rails at the other end E of the section.

The stretch of track is intersected at grade adjacent to section end E by a multiple lane highway H over which highway traffic operates in either direction, as indicated by the arrows shown associated with the highway in Fig. 1. The highway H is indicated by a dotted line as comprising two traffic lanes one for southbound traffic operating from top to bottom as viewed in Fig. 1 and the other lane for northbound traffic operating in the opposite direction.

Each of the highway lanes is provided with two retractable and projectable highway barriers located on opposite sides of the railway crossing and designated by the reference characters BN and BX, respectively. The barriers BN will be termed the entrance barriers and are disposed in the entering portion of each lane, that is, in the portion of the lane over which highway traffic

operates in approaching the grade crossing. The other barriers BX are located in the exit portions of the lanes over which traffic operates in leaving the crossing and these barriers accordingly will be termed exit barriers.

The barriers BN may be operated in any suitable manner, such as that hereinafter described in detail in connection with barriers BX, so as normally to occupy a retracted position wherein the back portion of the barrier is flush with the roadway and forms a part thereof, and to be projected, at such times as a train approaches the intersection, into the path of vehicles operating over the highway and approaching the intersection in an entrance lane thereof.

In accordance with an object of my present invention, the exit barriers BX are provided with novel and improved electropneumatic operating mechanisms arranged to permit a vehicle to be driven over a projected barrier without damage to the vehicle when it leaves the crossing, thereby to avoid trapping vehicles on the crossing. This improved form of operating means is illustrated in Fig. 2 applied to an exit barrier BX and it comprises a fluid motor 5, two magnet valves 6 and 7, a source of fluid pressure, control means for governing the magnet valves, and suitable piping, connections, valves and switches which will be set forth in detail presently.

Referring now to Fig. 2, barrier BX comprises a cast member 10 generaly triangular in shape in vertical section and having a back portion 10*a* that forms part of the roadway when the barrier is in its depressed position, and a front portion 10*b* which forms an impact portion and a protective skirt when the barrier is in its projected position. Member 10 is disposed in a pit provided in the highway and has its end nearest the grade crossing pivotally supported in any suitable manner, such as by a pin 11 secured to a portion of the framework of the pit.

Disposed in the pit is a fluid pressure motor 5 comprising an air cylinder 12 mounted on trunnions 8 at its lower end (as viewed in the drawing) and having its piston 13 connected to a pin 14 secured to barrier member 10. The motor 5 is proportioned with respect to the weight of member 10 so that under ordinary conditions a relatively low pressure of the order of eight pounds per square inch will just balance the barrier weight. The upper end of cylinder 12, as shown, is preferably enclosed by a member 15 provided with a choke exhaust valve 17, and a check valve 16 that permits air to flow from the atmosphere to the cylinder but not from the cylinder to atmosphere. Associated with the motor is a limit switch 18 comprising a movable member 19 forced by a spring 9 into engagement with barrier member 10*a* and carrying an insulating actuating piece 20 proportioned to force contact springs 21 and 22 into engagement with each other to form a circuit controlling contact 21—22 when the member 10 is in or between its retracted position (in which the member is illustrated in Fig. 2) and an intermediate position A indicated by dash lines in Fig. 2. When, however, member 10 is in its full projected position B (indicated by dash lines in Fig. 2) or intermediate positions A and B, then contact fingers 21 and 22 separate to open circuit controlling contact 21—22.

Fluid pressure from a suitable source, such as an air compressor (not shown) connected to a supply pipe 23, is supplied to cylinder 12 through a pipe 24 at such times as admission magnet valve 6 and exhaust magnet valve 7 are energized and move their respective valve stems 6*a* and 7*a* downward, as viewed in the drawing. When admission magnet valve 6 is deenergized and exhaust magnet valve 7 is energized, the supply of air to cylinder 12 is cut off and air is retained in the cylinder under the existing conditions of pressure; and when both admission and exhaust magnet valves are deenergized, the supply of air to the cylinder is cut off and cylinder 12 is then vented to the atmosphere as indicated in the drawing.

The pipe 24 adjacent to cylinder 12 is preferably of a relatively large size and has an auxiliary or second connection to supply pipe 23 comprising a branch pipe 25, also of large size, and a check valve 26 arranged to prevent the flow of fluid from the supply pipe 23 to cylinder 12 but to permit the flow of fluid from cylinder 12 to pipe 23 in the event that the fluid pressure in cylinder 12 builds up to a value above the pressure in the supply pipe. Associated with check valve 26 is a reservoir 27 for preventing rapid fluctuations in pressure.

Associated with cylinder 12 is a pressure operated switch 28 comprising a Bourdon tube 29 connected to pipe 24 and subjected to the pressure in such pipe. The tube 29 controls contacts 30 and 31 and is so constructed as to close contacts 30—31 whenever the pressure in the pipe is below a predetermined value, such as ten pounds per square inch, but to open the contacts whenever the pressure rises above the predetermined value.

The magnet valves 6 and 7 are governed by control means including a control device, herein shown as the track relay TR, and a slow releasing timing relay TER. When relay TR is picked up, relay TER is energized over an obvious circuit including the front point of contact 32 of relay TR and a suitable source of current, such as a battery 33. At this time, both magnet valves 6 and 7 are deenergized so that fluid pressure is cut off from cylinder 12 and the cylinder is vented to the atmosphere.

When relay TR releases in response to a train entering section D—E, the front point of contact 32 opens to deenergize relay TER and the back point of that contact closes to energize both magnet valves 6 and 7. Exhaust magnet valve 7 becomes energized over an obvious circuit including the back point of contact 32 of relay TR and battery 33, while the other magnet valve 6 becomes energized over a circuit that extends from one terminal of battery 33 through the back point of contact 32 of relay TR, contact 22—21 of the limit switch associated with the barrier BX, and the winding of magnet valve 6 to the other terminal of battery 33. Air at the pressure of the source (which pressure is preferably of the order of, say 100 pounds per square inch) is thus connected to the cylinder through the admission valve port. The admission valve port is restricted so that under normal conditions the barrier rises slowly and the pressure in the cylinder of course does not build up to a value above the 8 pounds per square inch required to project the barrier. Should, however, the barrier be stuck down by ice or debris, the pressure in cylinder 12 will build up and the full pressure of 100 pounds per square inch will be available to cause the barrier to break free. In either event, the admission magnet valve 6 is maintained energized until barrier member 10 reaches its intermediate or hesitation position A, whereupon limit switch 18 opens con-

tact 21—22 to deenergize magnet valve 6 and cut off the supply of air to the cylinder.

The barrier is maintained at its hestitation position (exhaust magnet valve 7 being energized) until relay TER drops at the end of a predetermined slow release interval. When this happens, admission magnet valve 6 becomes reenergized over a circuit which extends from one terminal of battery 33 through the back point of contact 32 of relay TR, the back point of contact 34 of relay TER, contact 30—31 of Bourdon tube 29 and the winding of magnet valve 6 to the other terminal of battery 33. Air is thus again admitted to cylinder 12 to cause member 10 to be projected to its full position B. During this operation, the pressure in cylinder 12 is limited by the pressure operated switch 28 to the previously mentioned predetermined pressure (hereinbefore assumed to be 10 pounds per square inch) and the member is held at its full position by this 10 pound pressure. It follows, therefore, that the apparatus embodying my invention is arranged to provide two ranges of pressure for operating the barrier, the first range normally being limited to the value required to lift the barrier member but being capable of exerting the full supply pressure should that be needed to break member 10 free of ice, snow or other obstructions, while the second range of pressure is limited to a low value just slightly greater than that required to hold up the barrier.

This second pressure range permits a vehicle to drive off the intersection without damage should the barriers be raised while the vehicle occupies the stretch between the two sets of barriers. Because of the low pressure in the exit barrier cylinder, the wheels of the vehicle will easily depress the barrier to substantially its retracted position. This might compress the air in the cylinder and build up a high pressure, but when the barrier reaches its intermediate or hesitation position, limit switch contacts 21—22 close and the admission magnet valve 6 becomes energized over its previously traced circuit, to connect cylinder 12 to the supply pipe 23 and thus permit air to be expelled into the pipe. Also, if the pressure in the cylinder reaches a value above that of the supply pipe, check valve 26 will then open to bleed off the excess pressure. The reservoir 27 adjacent to check valve 26 will of course function to absorb the excess air and prevents a rapid fluctuation in pressure such as might occur if the reservoir were not employed.

In spite of these means to minimize the compression pressure in cylinder 12 by allowing an actual displacement of the air to take place when a vehicle depresses the barrier, there will remain in the cylinder a considerable volume of free air at a relatively high pressure. This would tend to cause the barrier to rise after each pair of wheels clears the barrier. To prevent this and to slow up the rebound of the barrier, the top of the cylinder is fitted with its check intake valve 16 which permits air to flow into the top of the cylinder but not out of the cylinder, and restrictive exhaust port 17 which restricts the flow of air out of the top of the cylinder. The top of the cylinder accordingly functions as a buffer or snub so that the barrier will rise on a rebound at a speed that is determined by the rate at which the air in the top of the cylinder leaks out of the choke exhaust port.

When the train vacates section D—E, relay TR picks up to reenergize timing relay TER and deenergize the magnet valves 6 and 7, whereupon cylinder 12 is vented to the atmosphere and barrier member 10 is restored to its retracted position in response to gravity.

From the foregoing description, it is readily apparent that the apparatus embodying my invention provides for operating an exit barrier by an electropneumatic operating mechanism which incorporates novel and improved means for enabling vehicles to depress the barriers in leaving a highway crossing and to delay the rebound of the barrier, thus avoiding damage to such vehicles.

Although I have herein shown and described only one form of protective apparatus for highway crossings embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In a protective system for a railway-highway grade crossing of the type wherein a retractable and projectable barrier is provided in the exit lane of the highway over which highway traffic operates when leaving the crossing and is disposed to bar the entrance of traffic into the crossing over the barrier, the combination with a source of relatively high fluid pressure, a fluid pressure motor operatively connected with said barrier, a first means governed by a train on said railway approaching said crossing for connecting said motor with said source, means operated by said barrier for disconnecting said motor from said source when said barrier reaches a predetermined height, timing means controlled by said first means, a fluid pressure operated switch, and means governed by said timing means for rendering said fluid pressure operated switch active to reconnect said motor with said source, said fluid pressure operated switch being adjusted to limit the supply of pressure from said source to said motor to such times as the pressure in the motor is below a predetermined pressure less than the pressure of the fluid supply.

2. In a protective system for a railway-highway grade crossing of the type wherein a retractable and projectable barrier is provided in the highway adjacent to said crossing, said barrier being operable at times to bar the entrance of traffic into the crossing over the barrier, the combination with a source of relatively high fluid pressure, a fluid pressure motor connected with said barrier, a magnet valve effective when energized for admitting fluid pressure from said source to said motor, a first means for energizing said magnet valve, a switch on said barrier for rendering said first means ineffective when said barrier reaches a predetermined height, a timing means governed by said first means, a fluid pressure operated switch, and means governed by said timing means for rendering said fluid pressure operated switch active to energize said magnet valve when pressure in said motor is less than a preselected pressure substantially less than the pressure of said source.

3. In a protective system for a railway-highway grade crossing of the type wherein a retractable and projectable barrier is provided in the exit lane of the highway over which highway traffic operates when leaving the crossing, said barrier being disposed to prevent the passage of traffic into the crossing, the combination with a source of relatively high fluid pressure, a fluid pressure motor operatively connected with said

barrier, a first means governed by a train on said railway approaching said crossing for connecting said motor with said source, means operated by said barrier for disconnecting said motor from said source when said barrier reaches a predetermined height, timing means controlled by said first means, a fluid pressure operated switch, means governed by said timing means for rendering said fluid pressure operated switch active to reconnect said motor with said source, said fluid pressure operated switch being adjusted to limit the supply of pressure from said source to said motor to such times as the pressure in the motor is below a predetermined pressure less than the pressure of the fluid supply, and a branch line from said motor to said source including a check valve admitting air from said motor to said source when the pressure in said motor builds up to a value above that of said source due to a depression of said barrier.

4. In a protective system for a railway-highway grade crossing of the type wherein a retractable and projectable barrier is provided in the exit lane of the highway over which highway traffic normally moves when leaving the crossing, said barrier being operable at times to prevent the entrance into said crossing of traffic moving in said lane against the current of traffic, the combination with a source of relatively high fluid pressure, a fluid pressure motor connected with said barrier, a magnet valve effective when energized for admitting fluid pressure from said source to said motor, a first means for energizing said magnet valve, a switch on said barrier for rendering said first means ineffective when said barrier reaches a predetermined height, a timing means governed by said first means, a fluid pressure operated switch, means governed by said timing means for rendering said fluid pressure operated switch active to energize said magnet valve when pressure in said motor is less than a preselected pressure substantially less than the pressure of said source, and a branch line from said motor to said source including a reservoir and a check valve between said motor and reservoir for admitting air from said motor to said source when the pressure in said motor builds up to a value above that of said source due to a depression of said barrier.

5. In combination with a stretch of railway track intersected by a highway, a projectable and retractable barrier provided in an exit lane of said highway over which highway traffic normally operates in leaving the intersection, said barrier being disposed to bar the passage into the intersection of traffic moving against the normal current of traffic, a fluid pressure motor comprising a cylinder having an expansion chamber provided with a piston operatively connected with said barrier, means for controlling the admission and exhaust of fluid to said cylinder on one side of said piston for projecting and retracting said barrier respectively, a check valve provided for said cylinder on the opposite side of said piston arranged to permit air to enter but not to leave said cylinder, and an exhaust port for said cylinder on said opposite piston side for restricting the exhaust of air from that portion of said cylinder, said check valve and exhaust port functioning to enable a vehicle in said exit lane leaving said intersection and passing over said barrier to effect without delay the depression of said barrier when projected but delaying the return or rebound of the barrier to its projected position following a passage of the vehicle wheels.

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