Sept. 15, 1959 R. V. HARTY 2,903,854

DOOR CONTROLLING SYSTEM

Filed April 17, 1953 3 Sheets-Sheet 1

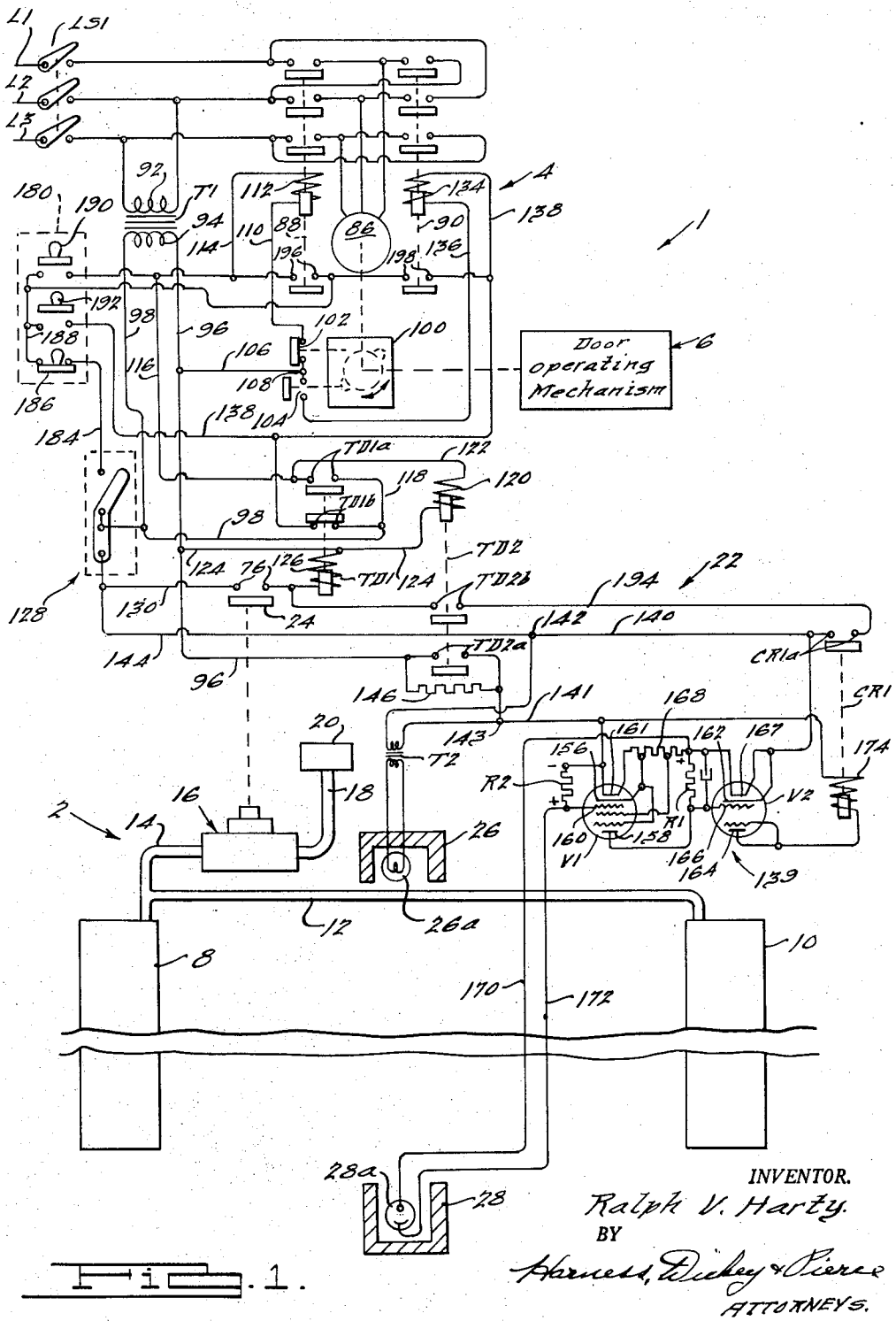

Fig. 1.

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DOOR CONTROLLING SYSTEM

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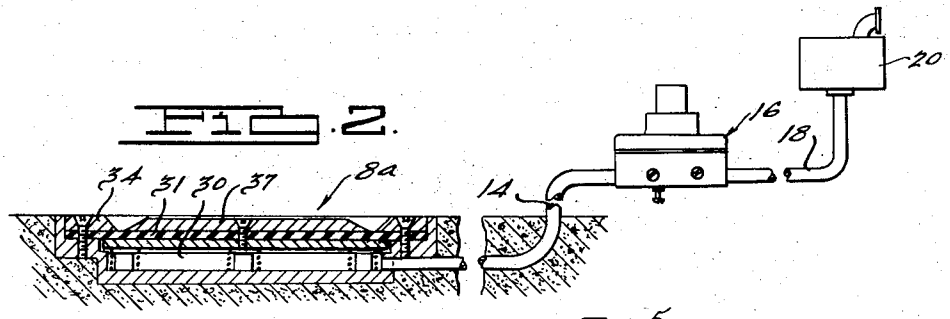

FIG. 2.

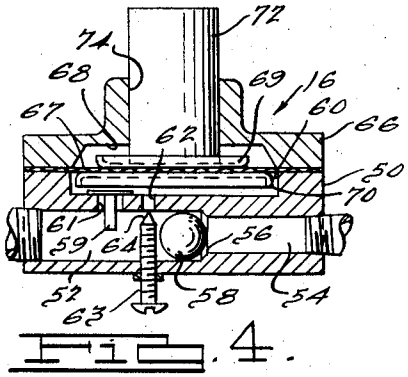

FIG. 4.

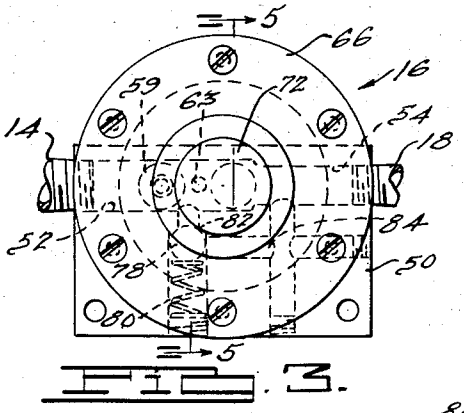

FIG. 3.

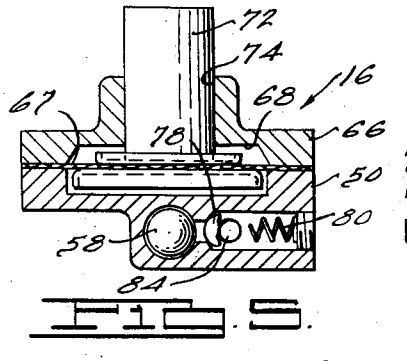

FIG. 5.

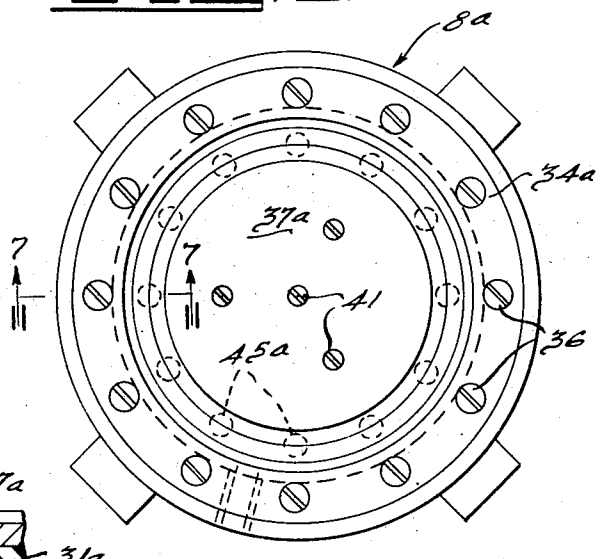

FIG. 6.

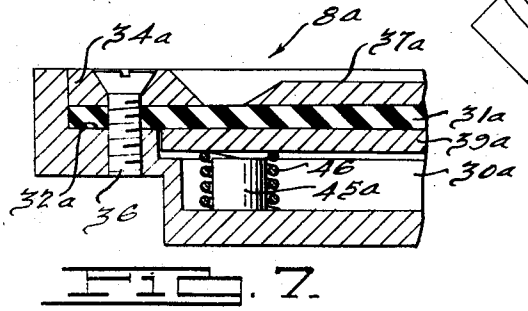

FIG. 7.

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DOOR CONTROLLING SYSTEM

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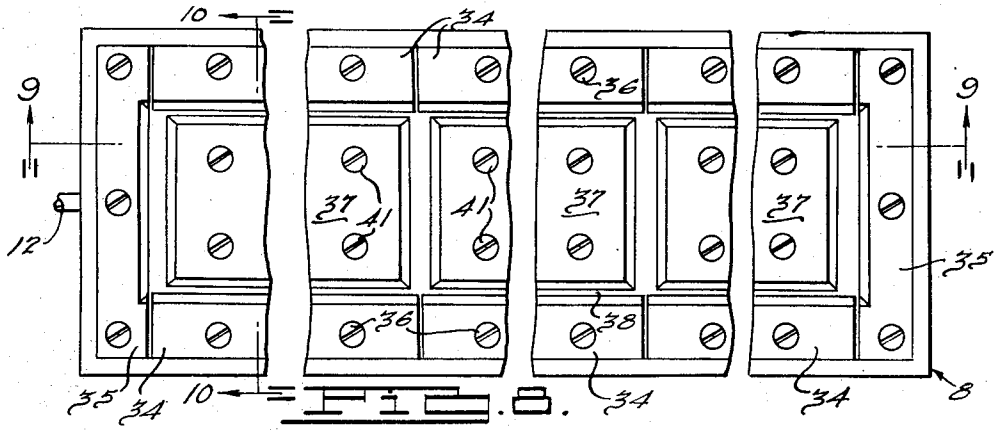

Fig. 8.

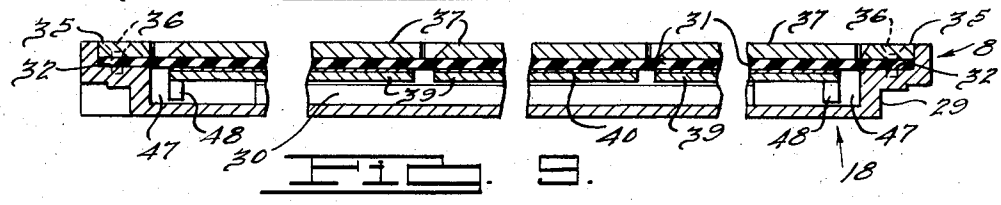

Fig. 9.

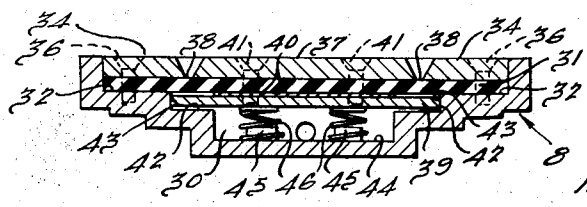

Fig. 10.

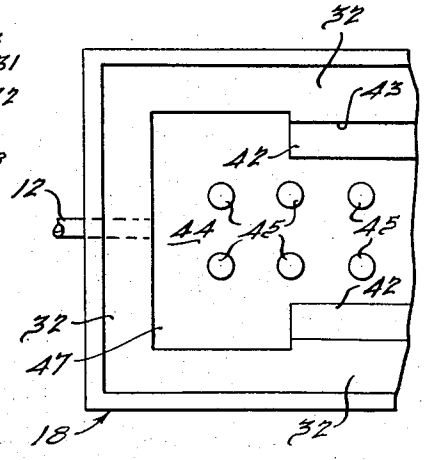

Fig. 11.

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United States Patent Office 2,903,854 Patented Sept. 15, 1959

2,903,854

DOOR CONTROLLING SYSTEM

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Application April 17, 1953, Serial No. 349,417

9 Claims. (Cl. 60—54.5)

This invention relates generally to door operators and more particularly to such an operator which moves the door to open position in response to the passage of a vehicle over a trip device and which holds the door in open position as long as the vehicle or other obstacle obstructs the doorway.

An object of this invention is to provide a new and improved door operator of the character described.

A further object of the invention is to provide such a door operator in which a pair of fluid actuated trip devices are placed in the pathway through the doorway so that the door is caused to open by a vehicle approaching from either direction.

Another object of this invention is to provide such a door operator with time delay means so that movement of the vehicle over the first trip device actuates an initiating switch which will normally remain actuated until the vehicle has passed beyond the first trip device to prevent actuation of the switch in response to passage of the various vehicle wheels thereover.

Other objects of this invention will be apparent from the description, the appended claims and the drawings, in which drawings:

Fig. 1 illustrates schematically a door operating system embodying the invention;

Fig. 2 is a diagrammatic view partly in section showing the hydraulic system portion of the door operating device;

Fig. 3 is a plan view of the hydraulic switch actuator shown in Fig. 2;

Fig. 4 is a view in substantial central vertical cross section of the switch actuator shown in Fig. 3;

Fig. 5 is a view taken substantially along the line 5—5 of Fig. 3 and looking in the direction of the arrows;

Fig. 6 is a plan view of the vehicle operated trip mechanism shown in Fig. 2;

Fig. 7 is a view taken substantially along the line 7—7 of Fig. 6 and looking in the direction of the arrows;

Fig. 8 is a broken plan view of a modified form of trip plate;

Fig. 9 is a view taken substantially along the line 9—9 of Fig. 8 and looking in the direction of the arrows;

Fig. 10 is a view taken substantially along the line 10—10 of Fig. 8 and looking in the direction of the arrows; and,

Fig. 11 is an enlarged partial plan view of the left-hand end portion of the actuator shown in Fig. 8 with certain parts of the trip plate removed.

The invention is useful in many different environments and therefore for the purposes of simplifying the description, it will be described as being embodied in connection with a doorway through which motor vehicles such as trucks are intended to pass. The door operating mechanism 1 comprises generally a hydraulic system 2, an electrical network 4 controlling a door operating mechanism 6 and a photoelectric network or system 22. The hydraulic system 2 includes a pair of transmitters, or

trip units 8 and 10 located in the roadway leading through the doorway and over which one or more wheels of the vehicle will pass. The units 8 and 10 are connected together by a conduit or pipe 12 and by a branch pipe 14 to a receiver in the form of a hydraulic switch actuator 16. The actuator 16 is also connected by conduit 18 to a liquid reservoir 20 whereby (as will be made clear below) the hydraulic system is maintained completely filled with liquid at all times and which permits breathing of the liquid system due to temperature changes.

The hydraulic switch actuator 16 is constructed to promptly close a switch 24 as a consequence of the vehicle passing over either of the trip units 8 or 10 and is further constructed to provide a time delay to prevent opening of the switch 24 for a time period which would normally be sufficient for the vehicle to completely pass over the actuated one of the trip units. Closure of switch 24 causes the network 4 to actuate the motor 86 thereof to drive the mechanism 6 to open the door. The network 4 is provided with a time delay relay TD1 to prevent closure of the door for a desired time interval subsequent to its de-energization. The relay TD1 is of the type in which its contacts TD1*a* close and TD2*b* open immediately upon becoming energized but contacts TD1*a* will not open and contacts TD1*b* will not close until the expiration of a predetermined time delay period subsequent to its de-energization.

As the vehicle passes through the door it breaks the light beam of the photoelectric system 22 located adjacent the door and the contacts CR1*a* close a circuit in parallel with the switch 24. As long as either the switch 24 or contacts CR1*a* are closed, the door will remain open and both must be open to initiate the timing out of the time delay period of relay TD1. This insures that the door will remain open until the vehicle passes completely therethrough. Since in usual installations the vehicle after passing through the door will also pass over the other of the trip units which is located on the opposite side of the door, the time delay period of the relay TD1 is arranged to be longer than the expected time for the vehicle to actuate the other trip unit so that as the switch 24 is actuated by the other trip unit as the vehicle leaves the door, it will be closed prior to the timing out of the relay TD1 to cause the actuator 6 to close the door. This prevents any partial closing and reopening of the door due to the actuation of the second or other trip unit.

Referring more specifically to the constructional details, the hydraulic system 2 comprises the pair of trip plates 8 and 10, placed in the roadway or path leading through the doorway, which is diagrammatically illustrated as passing between the U-shaped posts 26 and 28. The actual door is not shown since it may be of any usual type but which is understood to be located near the posts 26 and 28. Each of the trip units 8 and 10 are identical and the details of the trip unit 8 are shown in Figs. 9 through 12. The trip unit 8 comprises an elongated substantially rectangular chambered body member 29 having a liquid containing chamber 30 closed by a flexible resilient rectangular diaphragm 31 which seats at its peripheral edge portion on an upwardly facing peripheral shoulder 32 of the body member 29. These marginal portions of the diaphragm 31 are clamped to these shoulders 32 by plate-like clamping strips 34 and 35. The strips 34 are arranged along the longer edges of the body member 29 and are of sufficient width to overhang the inner edge of the peripheral shoulder 32 along such longer sides for a purpose which will be brought out below. The strips 35 are preferably the same width as the shoulder 32 across the shorter ends of the unit 8. The strips 34 and 35 are secured to the shoulder 32 to clamp the diaphragm 31 in fluid tight

relation by suitable means such as the plurality of shown screws 36. A plurality of rigid wear or diaphragm reinforcing plates 37 are placed on top of the diaphragm 31 and lie within the clamping strips 34 and 35 and, with the diaphragm 31 in its planar position, the top surfaces thereof lie in the plane of the strips 34 and 35. The plates 37 are of lesser width than the distance between the strips 34 to provide marginal flexing portions 38 to permit downward movement of the diaphragm when a vehicle wheel passes over one or more of the plates 37. The adjacent marginal edges of the plates 37 are also spaced from each other to permit movement of the plates 37 relative to each other and to the clamping strips 35. It will futrher be noted that V-shaped grooves are provided between the plates 37 and between plates 39 and strips 34 and 35, and this is also important in that it prevents ice and other formations therebetween which tend to interfere wtih the normal operation of the trip plate.

Rigid plates 39 are placed adjacent the underside of the diaphragm 31 within the chamber 30. These plates 39 may be located immediately against the underside of the diaphragm 31 but preferably are spaced slightly therefrom by spacers 40. The respective superimposed plates 37 and 39, spacers 40 and portion of diaphragm 31 are suitably clamped together as by screws 41. The opposite marginal edges of the plates 39 along the longer dimension of the unit 8 overlie and are normally spaced a short distance above shoulders 42 which extend throughout a major portion of the longer dimension of the body member 29 inwardly of the shoulders 32 and serve as stops to limit downward movement of the diaphragm 31 and plates 37 and 39 due to the weight of the vehicle passing thereover. The outer side marginal edges of the plates 39 are guided against side movement by guide wall portions 43 which extend between the shoulders 32 and 42. These outer marginal edges of the plates 39 also underlie the inwardly extending marginal edges of the side clamping strips 34 and cooperate therewith to limit upward movement of the diaphragm 31. The inner bottom wall 44 of the body member 29 is provided with two rows of spaced upstanding spring locating projections 45 which receive and position the lower ends of springs 46 which extend between the bottom wall 44 and the plates 39 and resiliently urge the diaphragm 31 into its planar upward position as shown. Appreciable upward movement above this planar position is limited by the overlying portions of the strips 34 above the plates 39. It will be apparent that the strength of the used springs 46 is selected to permit downward movement of the diaphragm 31 by any desired weight of vehicle.

The shoulders 42 terminate inwardly of the end walls of the body member 29 to provide enlarged end chamber portions 47. The end edges of the plates 39 which enter these chamber portions 47 are provided with abutments 48 which engage the bottom wall of the chamber portions 47 to limit downward movement of the plates 39.

Summarizing, it will now be understood that substantially all of the weight of a vehicle passing over the unit 8 will be carried by the rigid members thereof and the diaphragm 31 merely acts to permit relative movement thereof. The guiding engagement of the plates 39 by the wall portions 43 prevents tearing of, or undue stress being placed on, the diaphragm 31 due to the torque exerted by any wheel passing over the unit 8. Also, the pressure increase in the hydraulic unit is not necessarily a function of the weight of the load passing over the trip unit since the major weight is carried by engagement of rigid members.

The switch actuator 16 comprises a lower casing portion 50 which is provided with aligned intersecting passageways 52 and 54 to which are respectively connected the conduits 14 and 18 leading from the trip units 8 and 10 and leading to the liquid reservoir or tank 20. A valve seat 56 is provided at the intersection of the passageways 52 and 54 and communication therethrough is controlled by a ball valve 58 which is normally in a position to allow flow of liquid at low rates between the reservoir 20 and the branch conduit 14 to permit breathing of the fluid system 2 in response to changes in its temperature and the system 2 is thereby maintained completely filled with liquid at all times and at a pressure which is determined by the liquid head in the reservoir 20. If breathing were not permitted a rise in temperature could increase the pressure of the system sufficiently to actuate the switch 24. At higher fluid flow rates such as would occur when, for example, a motor vehicle passes over the trip plate 8 and rapidly changes the effective volume of the trip plate chamber 30, the valve 58 moves to engage the valve seat 56 and prevent liquid flow from passageway 52 to the passageway 54 and permit the necessary increase in pressure to close the switch 24.

The body member 50 is provided with an outwardly facing pressure chamber 60 which is in fluid flow communication with the passageway 52 by means of a pair of ports 61 and 62. A check valve 59 cooperates with the port 61 to permit fluid flow solely from the passageway 52 into the chamber 60. The rate of flow through the passageway 62 is controlled by a restricting device 63 which comprises a screw threaded member threaded into the body 52 and which has a tapered end portion 64 movable with respect to the port 62 to regulate the restriction to fluid flow through the port 62. The device 63 also serves to limit the movement of the ball valve 58 away from the valve seat 56.

A second body member or cover plate 66 is provided above the chamber 60 and is held to the member 50 by suitable means, not shown, to clamp a diaphragm 67 to seal the chamber 60 and to provide an outer movable wall therefor. The member 66 is provided with a shoulder 68 spaced above the diaphragm 67. Rigid cup shaped plates 69 and 70 are suitably secured to opposite sides of the diaphragm 67 and cooperate with the shoulder 68 and bottom wall of chamber 60 respectively to limit movement of the diaphragm 67. A switch actuator 72 extends outwardly in guided relation in an aperture 74 in the body member 66 and is positioned in accordance with movement of the diaphragm 67 under control of the fluid pressure within the chamber 60 for actuating the switch 24 to close and open its contacts 76.

The reservoir 20 is in an elevated position with respect to the remainder of the liquid system and is normally maintained partially filled with the operating liquid. Normally the ball valve 58 is, as shown, spaced away from the valve seat 56, so that the reservoir 20 maintains the liquid system 2 completely filled with liquid. The temperature of the liquid system will normally vary in accordance with weather conditions, and therefore the liquid therein will expand and contract and more or less liquid will be required to maintain the system 2 completely filled. The rate of such expansion and contraction is slow and therefore liquid flow due to temperature changes to or from the reservoir 20 will be at low rates and the ball valve 58 will remain away from the seat 56. When, however, a motor vehicle or other object passes over the trip unit 8, a much more rapid flow of liquid will occur which will cause the ball valve 58 to move against the seat 56 to prevent flow to the reservoir 20. Liquid displaced from the unit 8 will then flow through the ports 61 and 62 into the chamber 60, causing the diaphragm 67 to flex outwardly, to push the switch actuator 72 to move the switch 24 to close the contacts 76.

As the vehicle leaves the initially operated trip unit 8 or 10, the check valve 59 will close the port 61 and fluid will flow in a restricted manner outwardly of the chamber 60 into the passageway 52 through the port 62. At this time the ball valve 58 may move from the valve seat 56 to permit some liquid to flow from the reservoir 20 into the actuated one of the trip plate chambers 30 as the springs 46 move the diaphragm 31 back to its normal position.

The rate of flow through the port **62** is sufficiently slow so that the actuator **72** will maintain the switch **24** in position to keep the contacts **76** closed for the time period normally required for the motor vehicle to pass over the actuated one of the trip units **8** or **10**. As the various wheels pass over the trip plate, liquid is forced out of the chamber **30** thereof into the fluid system. Some of this will again be forced into the chamber **60** and if the fluid pressure due to the weight of the vehicle raises the pressure above a desired safe value, other of this fluid will be by-passed from the passageway **52** to the passageway **54** through a pressure relief valve **78** controlled by the spring **80**. As will be seen in Fig. 4, such flow is from the passageway **52** through a valve port **82**, past the ball valve **78**, and through a passageway **84** to the passageway **54**. As will be appreciated, valve **78** prevents an undue pressure in the hydraulic system and more particularly in the chamber **60**. If the protection afforded by valve **78** is not desired, the valve can of course be eliminated.

The electrical network **4** is energized from a plurality of electrical conductors shown in this instance as being the conductors L1, L2 and L3 of a three phase electrical supply system. It will be apparent, however, that if desired a single phase supply can be used with the usual single phase reversing type motor instead of the shown three phase motor **86**. A line disconnect switch LS1 is provided to disconnect the network **4** from the electrical source when desired.

The motor **86** is connected with the conductors L1, L2 and L3 through the contacts of the relays **88** and **90** in such a manner that when the relay **88** is energized its contacts connect the motor **86** to the source for counterclockwise rotation and when the contacts of relay **90** are closed the motor **86** is connected for clockwise rotation.

The motor **86** upon energization rotates a limit switch actuating mechanism **100** and the door operating mechanism **6** which is connected through suitable mechanism to move the door to open and closed positions. Counterclockwise rotation of the motor **86** causes the door to be moved in an opening direction and clockwise rotation causes the door to be moved toward closed position. The limit switch actuating mechanism **100** is provided with a pair of switches **102** and **104** which are each normally closed but which are moved to open position when the door is open and closed respectively.

The operation of the mechanism **1** is as follows:

As a vehicle passes over one of the trip units **8** or **10**, liquid is forced into the chamber **60** of the actuator **16** to cause the switch **24** to close its contacts **76** to energize the relay TD1. The overlying relation of the strips **34** and the plates **39** prevent the diaphragm of the other of the trip plates or units **10** or **8** from being appreciably flexed upwardly by the increased pressure in the fluid system. Upon energization, relay TD1 closes its contacts TD1*a* and opens its contacts TD1*b*. Opening of the contacts TD1*b* is without effect since the circuit therethrough is now broken by the open switch **104**. Closure of the contacts TD1*a* energizes the relay TD2 and motor relay **88** through circuits already described. Upon energization, the relay TD2 closes its contacts TD2*a* and TD2*b*. Closure of the contacts TD2*a* closes the shunting circuit around the voltage reducing resistor **146** to cause full voltage to be applied to photoelectric system **22**. Closure of the contacts TD2*b* places the obstruction responsive control circuit for the relay TD1 under control of the relay CR1 of the system **22**. This circuit extends from the bus **98** through the switch **128**, conductor **144**, normally open contacts CR1*a*, conductor **194**, and contacts TD2*b* to the winding **126** of the relay TD1. Whenever the light beam from source **26***a* falls on the photoelectric cell **28***a*, the valve V1 conducts to reduce the conduction of valve V2 to such an extent that relay CR1 maintains its contacts CR1*a* open. Due to the aforesaid time delay in the switch actuator **16**, the contacts **76** will remain closed for a time period which has been previously described which is usually long enough for the vehicle to completely pass over the trip unit and into a position to interrupt the light beam from source **26***a*. Contacts CR1*a* then close to maintain the relay TD1 energized or to re-energize it if the contacts **76** have opened. In either event, the relay TD1 will, under normal operations, be energized prior to the expiration of its time delay period. As the vehicle passes beyond the door the light beam will again fall on the cell **28***a* and relay CR1 will open its contacts CR1*a*. However, either before the opening of the contacts CR1*a* or before the time period of relay TD1, the vehicle will pass over the other of the trip units to reclose switch **24** and re-energize relay TD1. Switch **24** will remain closed until the vehicle clears this last trip unit. When actuator **16** times out, switch **24** opens and TD1 then times out to open its contacts TD1*a* and close its constacts TD1*b*. Closure of contacts TD1*b* energizes relay **90** which closes its contacts to energize the motor **86** to drive the actuator **6** to close the door. When the door has reached fully closed position the actuator **100** will open the switch **104** to break the circuit for the relay **90** which was initially established by closure of the contacts TD1*b*. Relay **90** then opens its contacts to de-energize the motor **86**.

Relay TD2 is of a type similar to relay TD1 in which its contacts TD2*a* and TD2*b* close immediately upon its energization but which provides a time delay between the time that it is deenergized and its contacts TD2*a* and TD2*b* open. Therefore, when the contacts TD1*a* of relay TD1 open, the relay TD2 becomes deenergized and at the end of its time period its contacts TD2*a* and TD2*b* open to reduce the voltage to the system **22** and to render the relay CR1 ineffective to energize the relay TD1. If, as sometimes happens, the vehicle pauses in the doorway and remains there for a time period, the relay CR1 will remain energized. Under these conditions the closed contacts CR1*a* will maintain the relay TD1 energized until such time as the vehicle does clear the doorway. Upon clearing of the doorway the vehicle will normally pass over the other of the trip units and the mechanism **1** will operate as described above. If the second trip unit is not used or is not passed over by the vehicle, the time interval of TD1 is sufficient to insure clearing of the doorway before the motor **86** starts to close the door.

Manual operation of the door is accomplished by placing the switch **128** in its manual position in which the conductors **130** and **144** are de-energized and the switch unit **180** is energized. When it is desired to open the door, the switch **190** is momentarily closed to establish a circuit from the bus **98** through the switch **128**, the closed switch **186**, conductor **188**, switch **190**, conductor **114**, winding **112**, conductor **110**, switch **102** and conductor **106** to the bus **96**. Energization of the winding **112** causes the relay **88** to energize its motor controlling contacts to energize the motor **86**, actuating the door operating mechanism **6** for opening the door. The relay **88** is provided with a set of back contacts **196** which close a circuit in parallel arrangement with the switch **190** which may now be opened without effect upon the door opening operation of the motor **86** then in progress. When the door has reached its open position the actuator **100** will open the switch **102** breaking the circuit to the winding **112** of the relay **88** which then becomes deenergized to terminate further energization of the motor **86**.

When it is desired to close the door, the closing switch **192** is momentarily closed to establish a circuit from the bus **98** through switches **128** and **186**, conductor **188**, switch **192**, conductor **138**, winding **134** of relay **90**, conductor **136**, switch **104** and conductor **106** to the bus **96**. Relay **90** is thereby energized to close its motor controlling contacts for actuating the motor **86** in a door closing direction and to close its back contacts **198** which are connected in parallel with the switch **192** which may now be opened without interfering with the door closing operation then in progress. When the door reaches its fully

closed position the switch **104** will open, breaking the circuit through the winding **134**, permitting the relay **190** to open its contacts and de-energize the motor **86**. Opening of switch **186** will immediately stop the motor **86**.

The round trip plate **8***a* shown in Figs. 6 and 7 is desirable for smaller sized trip plates in which either foot traffic or a single wheel of a motor vehicle is used to operate the same. It will be apparent that the construction thereof is quite similar to that described in connection with the larger size trip plates and a further detailed description is not believed necessary except to state that the projections **45***a* also serve as stops to limit downward movement of its plates **37***a* and **39***a*.

What is claimed and is desired to be secured by United States Letters Patent is as follows:

1. In a device of the character described, a pair of fluid chambers each having a movable wall, a first passageway interconnecting said chambers in continual open communication, a fluid reservoir, a second passageway connecting said first passageway to said reservoir and including a normally open valve for maintaining said chambers completely filled with fluid, said valve including a member movable in said second passageway and normally positioned to allow fluid flow through said second passageway toward said reservoir at relatively slow flow rates, said member being flow rate responsive and movable to a position wherein it closes said second passageway in response to fluid flow therethrough toward said reservoir at rates greater than said relatively slow rates, whereby movement of the wall of one of said chambers in a first direction to decrease the volume thereof drives fluid toward said reservoir and thereby closes said valve and continued movement of said one chamber wall will then cause fluid to flow into the other of said chambers to cause said other chamber wall to move in response to movement of said one chamber wall.

2. The combination of claim 1 in which fluid flow restriction means is provided to retard the flow of fluid from said other chamber into said first passageway.

3. The combination of claim 1 in which fluid flow means is provided to permit relatively unrestricted fluid flow from said first passageway to said other chamber and to provide restricted fluid flow from said other chamber to said first passageway.

4. A fluid pressure trip mechanism comprising, a body having a fluid chamber with an open side and a peripheral wall bounding said open side, a plurality of stop members facing said open side, a rigid plate member disposed over said stop members and partly closing the open side of said chamber, a resilient member overlying said plate member and closing said open side, means overlying marginal portions of said resilient member and said rigid plate member and securing said resilient member to said body, a second rigid plate member overlying a substantial portion of said resilient member, and means securing said rigid plate members and said resilient member together.

5. A trip mechanism comprising, a chamber member substantially cup-shaped in cross section having a peripheral shoulder and a peripheral seating surface spaced outwardly of said shoulder, a first rigid member freely movable within an outer portion of said chamber member and seatable against said shoulder, a resilient member seating on said seating surface and overlying said rigid member, a frame member overlying said peripheral seating surface and a peripheral portion of said first rigid member, means securing said frame member to said chamber member to clamp said resilient member to said peripheral seating surface, a second rigid member overlying said resilient member and within said frame member and means securing said rigid members and said resilient member together.

6. The combination of claim 5 in which said first and second rigid members each comprise a plurality of separate rigid substantially coplanar plates.

7. A pressure responsive time delay switch actuator comprising, a casing having a chamber with a movable wall and a first fluid passageway spaced from said chamber, a pair of fluid passageways interconnecting said chamber with said first passageway, valve means controlling fluid flow through one of said pair of passageways arranged to permit fluid flow solely in one direction, the other of said pair of passageways being of limited flow capacity to provide continuous restricted area communication between said chamber and said first passageway, said first passageway being provided with a valve port and a valve member controlling fluid flow through said port, and means to restrict fluid flow through said other passageway, said first passageway valve member comprising a ball, movement of said ball away from said valve port being limited by said last named restricting means.

8. In a hydraulic system, a first housing having a first chamber closed by a movable wall and having a port for fluid flow to and from said chamber, means normally maintaining said wall in a first position whereby said chamber is normally of a first volume, a second housing having a second chamber closed by a movable wall and having a passageway with a pair of ports opening into said passageway, a first conduit connecting one of said pair of ports of said second housing to said first housing port, a reservoir having a storage chamber for liquid and having a port opening into said storage chamber, a second conduit connecting said reservoir port to the other of said pair of ports of said second housing, said second housing passageway being provided with a valve seat intermediate its said pair of ports, a valve member controlling flow through said seat and normally maintained in a position to permit fluid flow between said pair of ports of said second housing, said valve member being responsive to the rate of fluid flow through said seat and effective to close said seat at rates of fluid flow toward the reservoir above a predetermined minimum, and constantly open fluid flow means connecting said second chamber to said second housing passageway intermediate said seat and said second housing first port.

9. The combination of claim 8 in which said last named fluid flow means includes a valve device to provide a greater restriction to flow outwardly of said second chamber than inwardly to said second chamber.

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2,208,564	Roby	July 23, 1940
2,227,483	Bendz	Jan. 7, 1941
2,352,934	Bohannan	July 4, 1944
2,389,962	Dougherty	Nov. 27, 1945
2,456,869	Fowler	Dec. 21, 1948
2,472,815	Fleming	June 14, 1949
2,503,698	Williams	Apr. 11, 1950
2,561,321	Tate	July 17, 1951
2,564,067	Karp	Aug. 14, 1951
2,582,896	Acton	Jan. 15, 1952
2,606,761	Group	Aug. 12, 1952
2,629,005	Engelhard	Feb. 17, 1953
2,637,168	Davison et al.	May 5, 1953
2,674,874	Jones	Apr. 13, 1954
2,678,072	Verderber	May 11, 1954
2,698,516	Hjulian et al.	Jan. 4, 1955