Oct. 6, 1942. P. T. GILBERT ET AL 2,298,208

ELECTRIC SWITCH

Filed May 17, 1941 2 Sheets-Sheet 1

Fig. 1

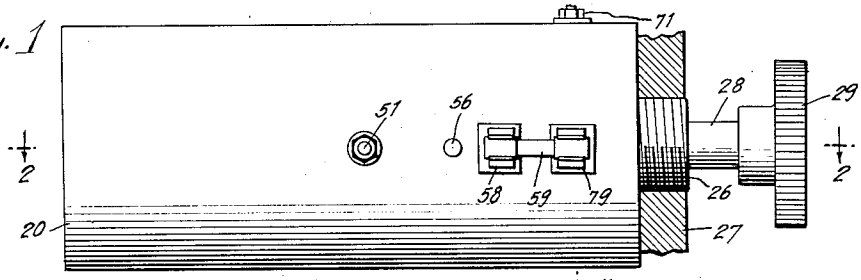


Fig. 2

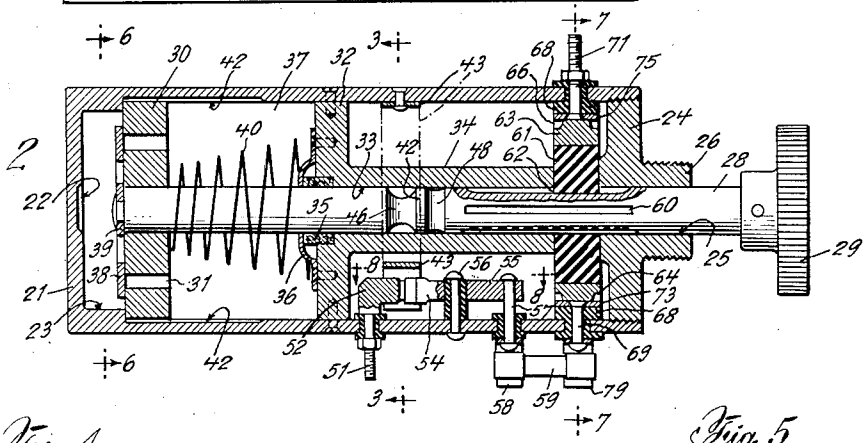


Fig. 4

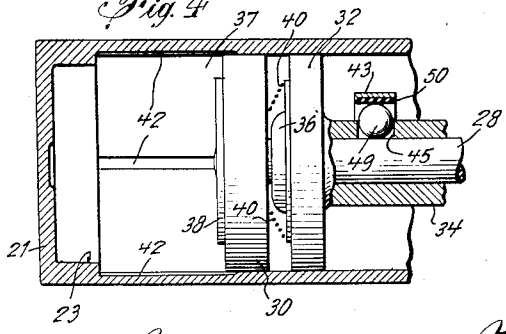


Fig. 5

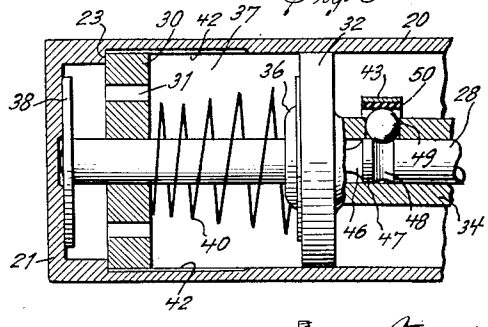


Fig. 6

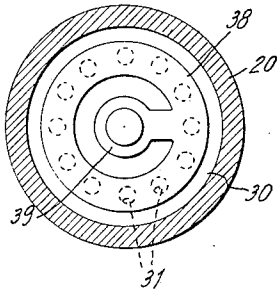


Fig. 3

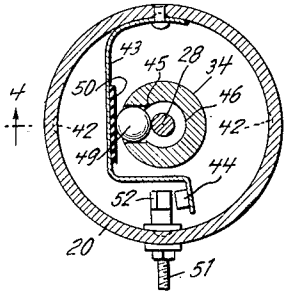
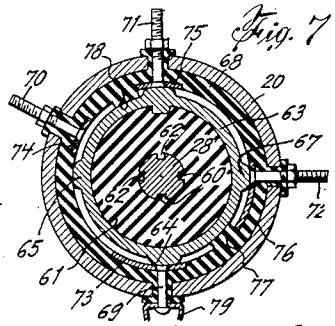


Fig. 7



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Fig. 9

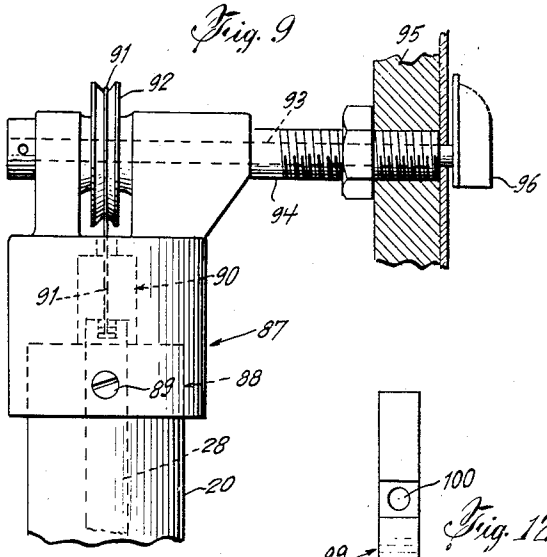


Fig. 10

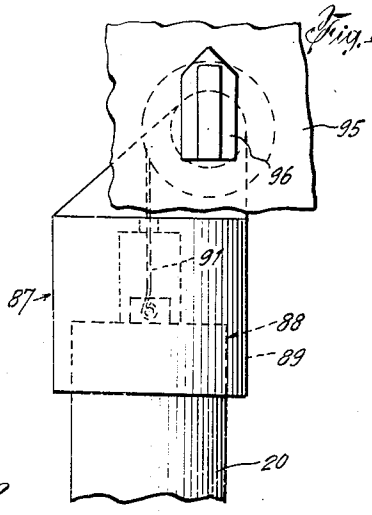


Fig. 12

Fig. 11

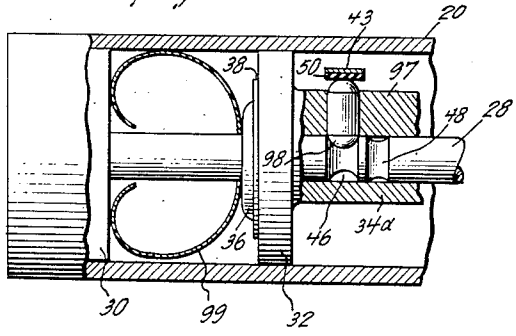


Fig. 8

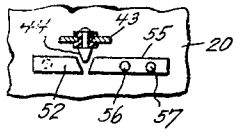


Fig. 14

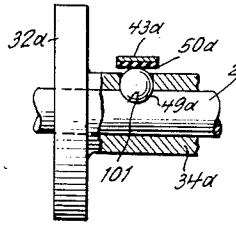


Fig. 15

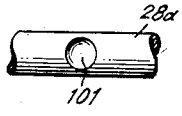
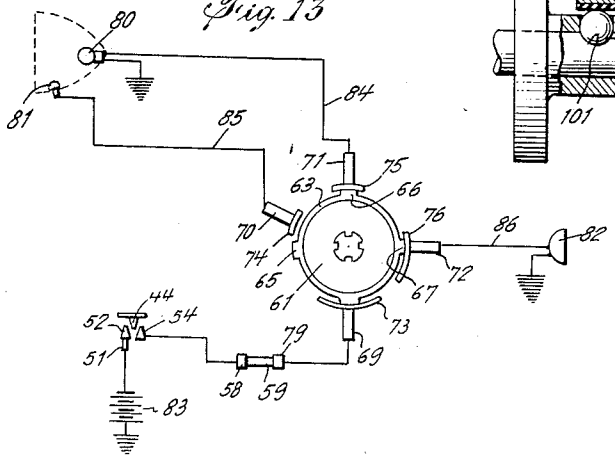


Fig. 13



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UNITED STATES PATENT OFFICE

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ELECTRIC SWITCH

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Application May 17, 1941, Serial No. 393,882

4 Claims. (Cl. 200—33)

This invention relates to electric switches and to means for operating the same, and has for one of its objects the provision of a combination time delay and multiple circuit switch whereby either of two or more circuits may be selectively placed in series therewith to cause delayed opening of the selected circuit. The device as illustrated is intended primarily for use on automotive vehicles in connection with the light circuits thereof, although it may readily be applied to other circuits and devices, such as any interior or exterior illuminating devices or any other electric appliances or devices other than lamps.

Another object of the invention is the provision of a switch unitary in construction and mounted completely within a housing, having means for closing the circuits selectively through any of the lighting circuits which may be in use on an automatic delayed opening of either the bright headlight or dim headlight circuits, selectively. Other lights may of course also be provided under control of the switch, such as an auxiliary or spot light, or pilot light, but such additions to, or even omissions from the circuits shown in the drawings, are matters within the skill of any electrician and they would not go beyond the spirit and scope of the present invention.

A further object is the provision of a novel means for operating a simple make and break electric switch, as well as the provision of a simple mechanical movement which is applied in this instance to the operation of a simple electric switch.

The above and other objects will become apparent in the description below, wherein characters of reference refer to like-numbered parts in the accompanying drawings. It is to be understood that the drawings serve the purpose of illustration only, and are not intended in any manner as a limitation on the scope or application of the invention.

Referring briefly to the drawings, Figure 1 is a side elevational view of the device showing the housing containing the same.

Figure 2 is a cross-sectional view taken on the line 2—2 of Figure 1, showing the related parts in normal or inactive position, with all circuits open.

Figure 3 is a cross-sectional view taken on the line 3—3 of Figure 2.

Figure 4 is a fragmentary cross-sectional view taken on the line 4—4 of Figure 3, but showing the pertinent parts in their relative positions with the time delay device in position ready for operation.

Figure 5 is a view similar to Figure 4 but showing the pertinent parts in their relative positions when the device is used as a simple circuit closer without use of the time delay means.

Figure 6 is a cross-sectional view taken on the line 6—6 of Figure 2.

Figure 7 is a cross-sectional view taken on the line 7—7 of Figure 2.

Figure 8 is a cross-sectional view taken on the line 8—8 of Figure 3.

Figure 9 is a side elevational view of a modified form of device secured to the dashboard of an automobile, for operating the switch from the dashboard.

Figure 10 is a front elevational view of Figure 9.

Figure 11 a fragmentary cross-sectional view similar to Figure 5, partly in side elevation, showing a modified type construction.

Figure 12 is a rear elevational view of the spring per se of Figure 11.

Figure 13 is a wiring diagram.

Figure 14 is a fragmentary view of a modified construction showing the means for opening or closing a simple switch.

Figure 15 is a fragmentary plan view of the rod per se of Figure 14.

Referring in detail to the drawings, the numeral 20 indicates a cylindrical housing having its rear end closed by a wall 21 integral therewith. The wall 22 is provided internally with a central recess 22, and with an internal peripheral shoulder 23. The other end of the housing is closed by a removable threaded screw cap 24 having an axial opening 25 therethrough and provided with a threaded flange 26 by means of which the housing may be secured to the rear side of an automobile dashboard 27.

A piston rod 28 extends slidably and rotatably through the opening 25 and has a removable knob 29 on its protruding end. The rod 28 has loosely mounted on its other end, a piston 30 provided with a plurality of annularly spaced holes 31 therethrough. A partition 32 is removably mounted within the housing 20 intermediate its length, and is provided with an opening 33 therethrough. The partition 32 has an elongated flange 34 surrounding the opening 33; the rod 28 extends slidably and rotatably through the opening 33. Suitable packing 35 and a locking means 36 for the same prevents liquid, such as oil, which is placed in the compartment 37, rearward of the partition 32, from escaping around the rod 28. A disc-like annular flap valve 38, of resilient ma-

terial, provided with a tongue 39 having an opening therethrough, is secured (by means of a rivet passing through) to the rear end of the rod 28. Normally the resiliency of the annulus 38 retains the same flush against the piston 30 and thus closes the holes 31. A spiral coiled spring 40 normally urges the piston 30 away from the partition 32. Within the liquid compartment 37, the housing is provided with a plurality of longitudinal grooves 42 which extend rearward to the shoulder 23.

Near the partition 32 and positioned intermediate the length of the flange 34, a contact spring 43 is anchored at one end in the housing 20; its other end extends to a point approximately diametrically opposite and has an insulated contact button 44 thereon. The mid-portion of the spring 43 passes relatively close to the flange 34, as shown, and directly under the spring 43 the flange is provided with a cylindrical opening 45 therethrough. Intermediate its length, the rod 28 has a peripheral groove 46 and closely adjacent thereto, in a forward direction, and separated therefrom by a ridge 47, a substantially similar but narrower and shallower peripheral groove 48. A ball 49 lies loosely in the opening 45 and, in the inactive position of the device as shown in Figures 2 and 3, normally rests in the groove 45. A layer of insulation 50 is secured to the spring 43, as shown.

A terminal 51 extends through the housing and is insulated therefrom and within the housing is secured to a metallic contact 52, wedge-shaped as shown in Figure 8. A second wedge-shaped contact 54 extends from a rigid conductor 55 mounted on posts 56 and 57 at an elevation above the floor of the housing. The post 57 is insulated from the housing, and the post 56 is insulated from the conductor 55. The post 57 has a fuse clip 58 thereon outside the housing to secure one end of a fuse 59 therein.

Forward of the groove 48, the rod 28 is provided with a plurality of peripherally spaced longitudinal grooves 60. A disc-shaped block 61, of insulating material, has an axial opening therethrough provided with radial ridges 62 therein, complementary to the grooves 60. The rod 28 passes slidably through the central opening in the disc 61, with the ridges 62 thereof registering in the grooves 60 of the rod 28; thus, the disc 61 will be rotated in unison with the rod 28, but it will not move longitudinally because it is restrained between the cap 24 and the flange 34.

A metallic ring 63 is locked against the periphery of the disc 61, to rotate therewith, and is provided with a plurality of contact teeth or shoes extending radially therefrom; in the illustration, there are four such shoes 64, 65, 66, 67, spaced a quadrant apart. A ring 68 of insulating material, composed of one or more concentric layers, is secured between the housing and the contact ring 63. At spaced intervals, four terminal screws 69, 70, 71, and 72 are arranged peripherally around the housing and pass through insulated openings therein, each terminating in an arcuate contact rail; the screw 69 in the rail 73, the screw 70 in the rail 74, the screw 71 in the rail 75, and the screw 72 in the rail 76. It is to be noted that the rails 73 and 76 are arcuately longer than the rails 74 and 75. The screws 71 and 72, and 72 and 69 are a quadrant apart from each other, whereas the screw 70 is spaced less than a quadrant from the screw 71 and more than a quadrant from the screw 69. Radial internal projections 77 and 78 from the insulation ring 68 which project into the peripheral space between the rings 68 and 63, serve as limit stops to the rotary movement of the disc 61, and hence the rod 28, in both directions. A fuse clip 79 is secured to the outer end of the screw 69, and supports the other end of the fuse 59.

By referring to Figure 7 and to the wiring diagram of Figure 13, the operation of the selective switch unit just described will become apparent. For the sake of simplicity, the wiring diagram contains but one bright headlight 80, a single separate dim headlight 81, and a single tail light 82. All these lights, as well as the battery 83, are grounded. A wire 84 leads from the light 80 to the terminal 71; a wire 85 leads from the light 81 to the terminal 70; a wire 86 leads from the tail light 82 to the terminal 72; the current path from the terminal 69 leads through the fuse 59 to the spring contact 54. When the contacts 54 and 52 are closed by the button 44, the path from the terminal 69 to ground is closed through the battery 83.

Assuming that the members 52 and 54 are in mutual contact, then it is obvious that the circuits through the headlight 80 and the tail light 82 are closed as represented in Figures 7 and 13, and that through the dim light 81 is open. If now the rod 28 is rotated clockwise until the shoe 67 is stopped by the limit stop 77, the shoe 66 will have left contact with the rail 75 and the shoe 65 will have established contact with the rail 74; the shoes 64 and 67 will have maintained contact with their respective rails 73 and 76 because of the greater length of the latter rails. In this new position then, the circuit will be open through the bright light 80 and closed through the dim light 81. Obviously any other arrangement of contacts and lights or other electric loads may readily be made, based upon the principle of structure and operation just set forth.

Assuming now that the device is in the completely inactive position shown in Figures 2 and 3, wherein the switch 52—44—54 is open, and it is desired to light either the bright headlights and the tail light, or the dim headlights and the tail light, then the knob 29 may first be rotated into position to close the desired circuits, as just set forth (which position of the knob may be indicated on a dial, not shown), and then the knob 29 is pushed in as far as it will go. The latter movement of the knob will force the rod 28 through the piston 30 into the position shown in Figure 5, with the annulus 38 stopped by the wall 21. During this movement of the rod 28, the ball 49 will have risen out of the groove 46, climbed the ridge 47 and fallen into the shallower groove 48. As soon as the ball thus begins its rise out of the groove 46, it lifts the spring 43 and brings button 44 into contact with the buttons 52 and 54, thus closing the circuit through the battery and through the tail light and the selected headlights. The ball maintains the said contacts in closed position as it lies in the shallower groove 48, as the radial depth of this groove is insufficient to free the button 44 from the buttons 52 and 54. By engagement of the ball in the shallow groove 48, a releasable stop lock is provided to maintain the rod 28 in the said position so that the said contact buttons remain in closed circuit position until the shaft 28 is forcibly pulled out.

The above operation may be effected equally well by reversing the sequence, i. e., by first pushing the knob 29 all the way back and then rotating it, as is obvious.

Either of the two combinations of circuits, i. e., the bright headlights and the tail light, or the dim headlights and the tail light, may be provided with the time delay means to open automatically after an interval of time, and this means may be set in motion regardless of the prior position of the various parts. Assuming that the ring 63 has been rotated by the knob 29 into the desired position, the circuits which are then indicated to be closed will be closed by pulling the knob forward, whence the shaft 28 carries the piston 30 in the same direction through the medium of the annulus 38 again at the force of the spring 40. The oil, not shown, contained in the compartment 37, will then flow rearward through the holes 31 and will force back the ring 38, in the fashion of a flap valve, as previously mentioned. The maximum forward position of the shaft 28 is shown in Figure 4. The moment the ball 49 is thus made to climb out of its groove, it again causes the button 44 to bridge the contacts 52—54 to close the circuit from the terminal 69 through the battery to ground, as described above. Thus the selected circuit is closed and remains closed for the interval of time, because, upon release of the knob 29, the piston 30 will be slowly pushed rearward by the spring 40, the ring 38 maintaining the holes 31 closed so that the only path for the oil is through the housing wall grooves 42. When the piston reaches the shoulder 23 and is stopped thereby, the groove 46 will also have reached a position directly under the ball 49 and the latter will have fallen into the groove, thus releasing the spring 43 and permitting the latter to withdraw the button 44 from the contacts 52—54 and opening the circuit from the battery.

It is to be noted that a small number of the parts of the device described above constitute in themselves a complete simple switch or circuit opener and closer. These parts constitute the rod 28 provided with the peripheral groove 46, and the wall 33 provided with the flanged opening 33 through which the rod 28 is slidable, the flange 34 with its ball-receiving opening 45, and the ball 49. In other words, these parts by themselves may be made, in conjunction with any spring contact button such as 44 and a stationary contact button such as 52—54, to serve as a simple switch.

In Figures 9 and 10 a means has been illustrated whereby the length of the time interval for the delayed opening of the switch may be predetermined and controlled with precision. Herein a support 87, secured in any desired manner to the frame or wall, has an opening 88 in the bottom thereof in which the forward end (right-hand end, Figure 1) of the housing is secured in vertical position by screws or other means 89. A vertical axial opening 90 extends through the support 88, and therethrough hangs a cable 91 which is attached to the forward end of the rod 28. The cable 91 is secured on a pulley or drum 92 which is rigid on a shaft 93 which projects through a sleeve 94 and through the wall 95, which may be the dashboard of an automobile. The knob 96 may be in the form of an index finger, as shown, and a dial may be provided on the face of the wall 95. This dial 96 may be graduated in minutes.

It is apparent that the greater the angle through which the knob 96 is rotated, the farther the shaft 28 will be pulled out of the housing 20, and the time interval for reopening the closed circuits will depend upon the angular position of the knob at the moment it is released.

In the modified structure of Figures 11 and 12, the flange 34*a* of the partition 32 is thickened at the top, at 97, so that a pin 98 may be contained therein instead of a single ball, with the lower rounded end adapted to register in the groove 46 or the groove 48. Likewise, herein is shown, instead of the spiral spring 40, a wing-shaped spring 99 provided with a hole 100 through which the rod 28 extends, between the piston 31 and the partition 32. This modified structure obviously functions in the same manner as that first described.

It is to be noted that the switch 52—44—54 is so constructed that no current passes through the spring 43, and that hence a relatively heavy current load may pass through these contacts (which may be built heavy enough for that purpose) without creating any resistance heat in this spring, thus adding life to the spring.

It is of course apparent that any number of circuits and combinations of circuits may be provided for the switch unit shown in Figure 7, by adding to or taking away from the number of contact shoes and contact rails shown therein, or by varying the relative positions thereof or the lengths of the rails. Likewise, the entire device or any useful part of it may be applied to other electric circuits of any and all types, for use in other fields and applications than those mentioned.

Obviously, other modifications in form and structure may be made without departing from the spirit and scope of the invention. One example of such modification, in the case of the parts mentioned above which constitute a simple switch or circuit closer and opener, is that by having, instead of the peripheral groove 46, merely a peripheral recess, distortion or deformation indentation, in which the ball normally rests and also having the rod 28 rotatable instead of slidable as mentioned. Then rotation of the rod in one direction will eject the ball from its recess to close the switch and reverse rotation will restore the ball to the recess to open the switch.

Such modification is illustrated in Figures 14 and 15, the former being a view similar to Figure 4 but omitting such parts as are unnecessary to illustrate the modification. In these figures, moreover, parts which are similar to those of Figure 4 are indicated by the same reference numeral followed by the letter *a*. The essential difference is that instead of having a peripheral groove in the rod 28*a*, a spherical recess 101 is provided therein which normally receives the ball 49*a*. Herein rotation of the rod 28*a* on its axis will cause the ball 49*a* to be lifted out of its recess to raise the spring 43*a* and close a circuit in the same manner as that 52—44—54, and reverse rotation of the rod to the same degree will, obviously, cause restoration of the ball to its normal position and thus open the circuit. This form of simple switch operating means may also be operated by longitudinal movement of the rod, as well as rotary movement. In either the rotary or longitudinal application of this mechanism, suitable limit stops, not shown, could be provided to limit such movement to an "on" position at one end of the range and to an "off" position at the other.

We claim:

1. In a housing having a chamber provided with a piston slidable in said chamber, valve means associated with said piston, the piston rod

of said piston extending through one wall of said chamber and having an indentation in the surface thereof, a member registering loosely in said indentation, circuit-opening and closing means adjacent said member, means cooperating with said indentation for closing said circuit means upon movement of said rod in one direction and for opening said circuit upon reverse movement of said rod, hydraulic means for delaying said movement of said rod in one of said directions, a switch associated with said housing having a plurality of contacts adapted to be connected to a plurality of separate loaded circuits and having means for selectively closing said circuits through said contacts, each of said circuits being connected in series with said first-named circuit means.

2. In a housing having a wall provided with an opening therethrough, a rod slidably mounted in said opening and having ball-receiving means thereon having a ball mounted loosely therein, circuit-opening and closing means adjacent said ball, means cooperating with said ball receiving means for closing said circuit means upon movement of said rod in one direction and for opening said circuit means upon reverse movement of said rod, means for delaying said last-named movement of said rod, a switch associated with said housing adapted to be connected to a plurality of separate loaded circuits and having means for selectively closing said circuits, each of said circuits being connected in series with said first-named means.

3. In a housing having an oil chamber, a rod extending slidably through the front wall of said chamber and having ball-receiving means thereon, a ball normally loosely mounted in said means, a piston in said chamber loosely mounted on said rod, said housing having a limit stop to limit the rearward movement of said piston with respect to said housing, resilient means normally urging said piston rearward, a limit stop on said rod to limit the rearward movement of said piston with respect to said rod, circuit-opening and closing means adjacent said ball, means cooperating with said ball-receiving means for closing said circuit means upon forward or rearward movement of said rod by ejecting said ball from said ball-receiving means, said rod limit stop causing said rod to draw said piston forward upon forward movement of said rod, hydraulic means for delaying rearward movement of said piston, said rod limit stop causing said piston to draw said rod rearward during rearward movement of said piston, said rod being adapted to be pushed rearward through said piston to the rear wall of the housing to maintain said circuit means in closed condition, and releasable locking means including said ball for releasably retaining said rod in said last-named position.

4. In a housing having an oil chamber, a rod extending slidably through the front wall of said chamber and having ball-receiving means thereon, a ball normally loosely mounted in said means, a piston in said chamber loosely mounted on said rod, said housing having a limit stop to limit the rearward movement of said piston, with respect to said housing, resilient means normally urging said piston rearward, a limit stop on said rod to prevent limit the rearward movement of said piston with respect to said rod, circuit-opening and closing means adjacent said ball, means cooperating with said ball-receiving means for closing said circuit means upon forward or rearward movement of said rod, by ejecting said ball from said ball-receiving means, said rod limit stop causing said rod to draw said piston forward upon forward movement of said rod, hydraulic means for delaying rearward movement of said piston, said rod limit stop causing said piston to draw said rod rearward during rearward movement of said piston, said rod being adapted to be pushed rearward through said piston to the rear wall of the housing to maintain said circuit means in closed condition, and releasable locking means including said ball for releasably retaining said rod in said last-named position, said last-named means comprising in addition to said ball an indentation in said rod spaced from said ball receiving means and adapted to receive said ball when said rod is in said last-named position.

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