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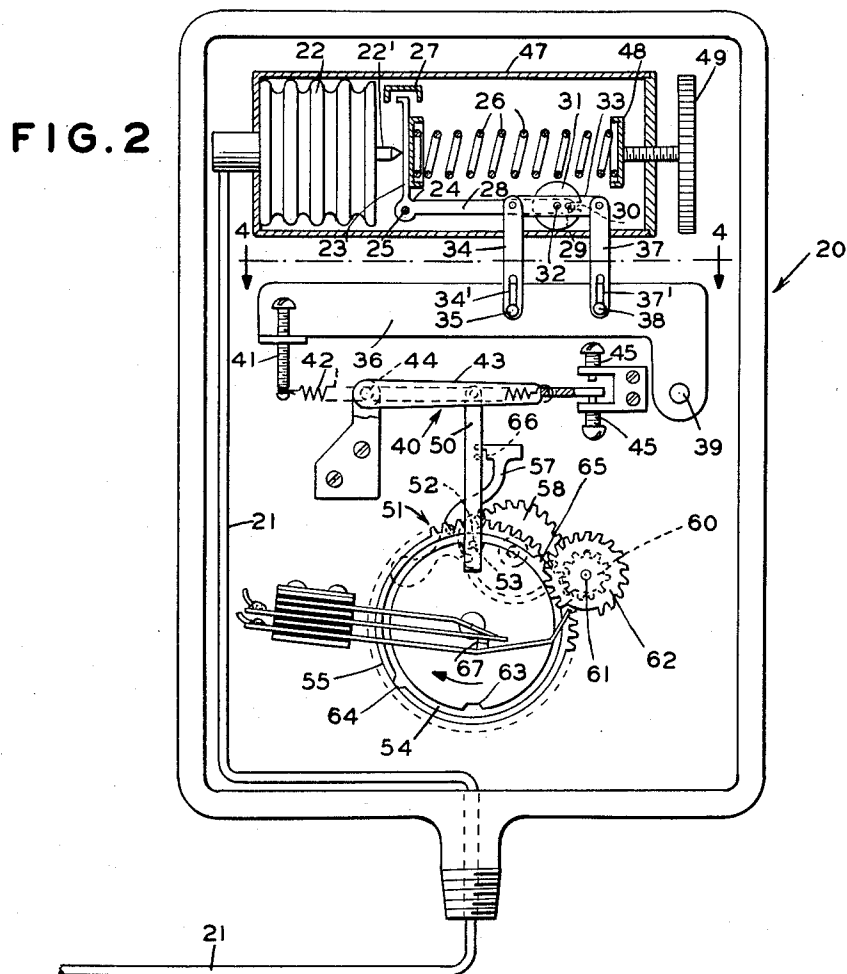
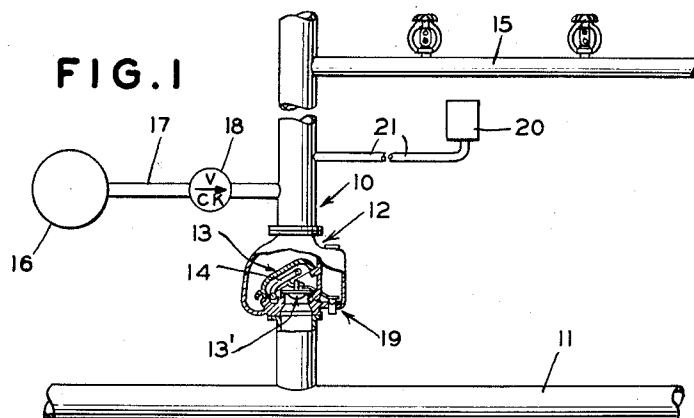
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SIGNAL TRANSMITTING APPARATUS

Filed Oct. 7, 1958

2 Sheets-Sheet 1



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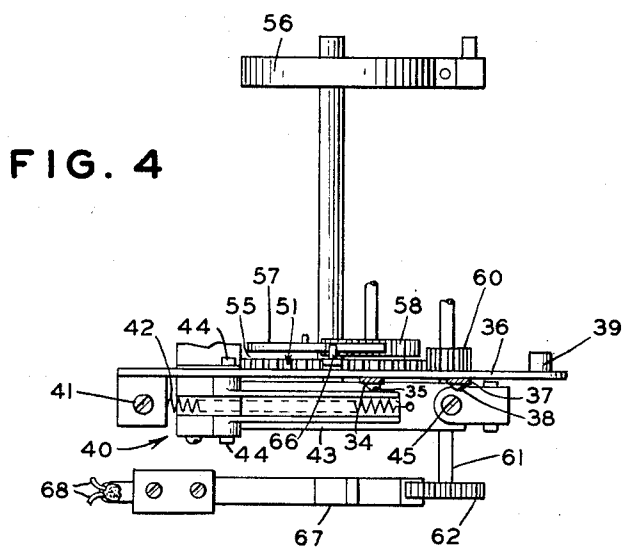
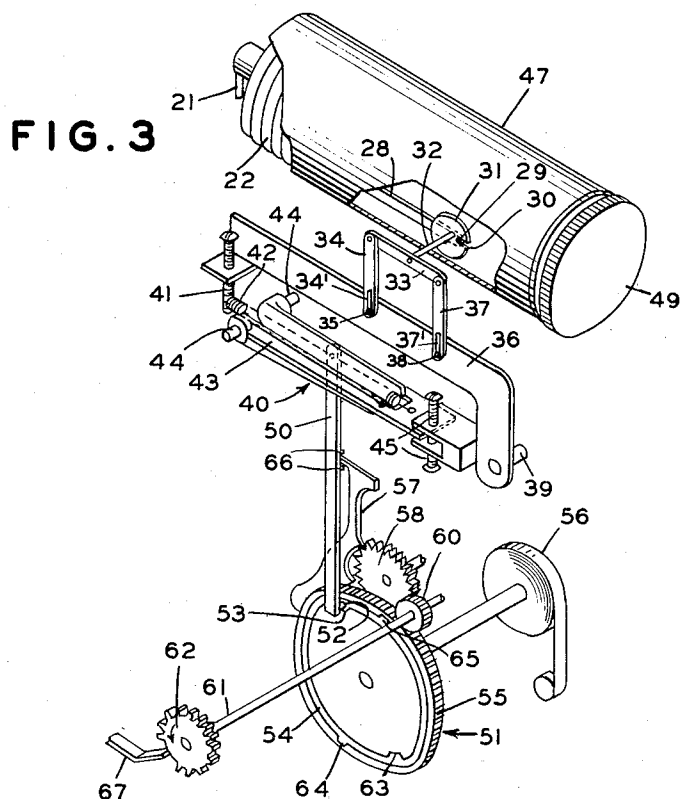
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SIGNAL TRANSMITTING APPARATUS

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This invention relates to pressure responsive means and more particularly to pressure responsive means especially well suited for use in supervising the air pressure in "dry pipe" type fire sprinkler systems.

Dry pipe fire sprinkler systems are well known in the art and are normally maintained free of water or dry until the occurrence of a fire at which time water is automatically admitted to the system. In one type of system the fire sprinkler system piping is filled with air under pressure which serves to maintain the water valve, providing communication between the sprinkler system and the water main, closed against the water pressure. When one or more of the sprinkler heads open due to the heat from a fire, air discharges therefrom and, when the pressure has dropped sufficiently the pressure of the water in the water main opens the water valve admitting the water to the system. It is necessary to maintain close supervision of the air pressure in such systems because if the pressure should drop inadvertently and permit water to enter the system prematurely the system may be disabled and rendered useless in the event of a fire. For example, freezing and consequent equipment damage may occur where the dry pipe sprinkler system is installed to protect an unheated storage area exposed to extreme cold. Because the time interval, which must elapse from the opening of a sprinkler head until sufficient air has been discharged to drop the pressure sufficiently to admit water to the system, increases with increased air pressure in the system it is also important that close supervision be maintained to insure that an excessively high pressure is not maintained.

While the present invention is applicable to a wide variety of apparatus in which it is desired to provide an indication of a departure, whether an increase or decrease from a predetermined pressure, it provides unique advantages when utilized in conjunction with the aforementioned dry pipe fire sprinkler systems.

It is, therefore, a principal object of the present invention to provide an apparatus which efficiently and dependably provides an indication whenever the pressure within the supervised system exceeds or drops below predetermined maximum and minimum values.

A further object is to provide such apparatus in which the normal operating range may be readily varied without disturbing the sensitivity of the system to departures in the value of the pressure from the established range.

Yet another object is to provide such apparatus which is highly dependable in operation but yet is of relatively simple construction, well adapted to mass production methods.

Further objects as well as advantages of the present invention will be apparent from the following description of a preferred embodiment and the accompanying drawings in which:

Figure 1 is a diagrammatic view of a dry pipe fire sprinkler system incorporating the present invention;

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Figure 2 is an elevational view, partially diagrammatic of the supervisory pressure transmitter;

Figure 3 is a perspective view, partially broken away, showing the linkage between the pressure sensing means and the clockwork transmitter; and

Figure 4 is a cross-sectional view taken through the line 4—4 of Figure 2.

Referring to the drawings in detail, the present invention will now be described in conjunction with a dry pipe sprinkler system and alarm system of the type in which the normally closed sprinkler system is maintained filled with air at some suitable pressure, such as, for example, 20 to 40 p.s.i. The system comprises a riser 10 which communicates with a water main 11 through a valve 12 having an air clapper 13 and a water clapper 13'. The air clapper 13 of valve 12 is inclined at an angle to the waterway and has an effective area which is larger than the effective area of the water clapper 13', the latter being positioned on the wet side of the valve. In the present instance the air clapper 13 has an area approximately six times that of the water clapper so that a given pressure above valve 12 is effective to withstand a pressure in main 11 and acting on the water clapper 13' which is about six times greater. The two clappers are interconnected by a link 14 so that movement of one is transmitted to the other. Riser 10 communicates with various conduits 15 which have sprinkler heads mounted thereon.

The sprinkler system including the riser 10 and the various conduits 15 are normally maintained dry by means of air pressure maintained at a value which is sufficient to keep the clappers of valve 12 on their respective seats. That is to say, water is prevented from entering the system through valve 12 by reason of the air pressure in riser 10 and conduits 15 which is maintained by a compressor 16. When operated, compressor 16 pumps air through pipe 17 past check valve 18 into riser 10.

The section of valve 12 intermediate clappers 13 and 13' is normally vented to the atmosphere through a velocity check valve 19 of the type which is maintained closed when water is flowing through valve 12.

Pressure responsive supervisory means 20 communicate with the interior of riser 10 through pipe 21 for providing an indication when the air pressure in the system drops below or exceeds predetermined minimum and maximum values. Supervisory means 20 comprises a pressure sensing element such as bellows 22 the interior of which communicates through pipe 21 with riser 10. The movable end 22' of bellows 22 is translated linearly through a distance depending upon variations in the pressure within its interior. This motion is transmitted to an arm 23 of an L-shaped lever 24 which is pivotally mounted as indicated at 25, stop 27 serving to limit rotation of lever 24 about its pivot 25. A range adjusting spring 26 serves to bias lever 24 so as to maintain arm 23 against the movable end 22' of bellows 22. One end of spring 26 butts against arm 23 and its other end engages a stop 48 carried by adjusting screw 49. Adjusting screw 49 extends through a wall of a casing 47 on the opposite end of which bellows 22 is mounted. Pivot 25 of L-shaped lever 24 is fixed to casing 47.

The free end of arm 28 of the lever 24 carries a pin 29 which extends therefrom into a slot 30 formed in link 31. Link 31 is a disk having a central hole by means of which it is fixed to a shaft 32 extending through and rotatably supported by a side wall of casing 47. A lever 33 is fixed to shaft 32 externally of casing 47 and is rotatable about its center with shaft 32. Thus, rotation of lever 24 is transmitted through link 31 and shaft 32 to lever 33.

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Lever 33 is pivotally connected to a link 34 at one end and to a link 37 at the other end thereof. Link 34 has an elongated slot 34' formed therein in which a pin 35, fixed to a main operating link 36, is slideable. Similarly, link 37 is also provided with an elongated slot 37' in which a pin 38 fixed to link 36 is slideable.

Main operating link 36 is pivotally mounted at 39 adjacent to one end thereof and adjacent to its opposite end is connected to a toggle assembly 40 through an adjusting screw 41 which is in turn connected to one end of toggle spring 42. The other end of toggle spring 42 is connected to the base of a U-shaped toggle 43 pivotally supported by means of a pair of pivots 44. The base of U-shaped toggle 43 is displaceable through a limited arc between a pair of adjustable stops 45. The apparatus is preferably installed so that toggle 43 extends horizontally and the adjustment of screw 41 is such that toggle 43 is normally free to rest against the lower toggle stop 45 (as viewed in Figure 2). The adjustment of screw 41 and spring 42 is made with bellows 22 exposed to a pressure having a value midway between the desired minimum and maximum pressure values within which the pressure in the sprinkler system is to be maintained under normal conditions and in the absence of a fire.

When the pressure in the system, and thereby the pressure within bellows 22, increases or decreases by a predetermined amount, in the present instance somewhat less than 10 p.s.i., L-shaped lever 24 is correspondingly rotated clockwise or counterclockwise, about its pivot 25 thereby rotating link 31 and its shaft 32. This motion of link 31 is transmitted to lever 33 which is also rotated. As the apparatus responds to an increase in pressure, lever 33 is rotated clockwise, as viewed. Thus, links 34 and 37 are displaced in opposite directions, link 34 being raised and, due to the engagement of link 34 with pin 35, main operating link 36 is rotated clockwise about its pivot 39. Slot 37' formed in link 37 prevents this link from interfering with the rotation of link 36. The motion of link 36 is ineffective to disturb toggle 43 until spring 42 is tensioned sufficiently to snap toggle 43 from its normal position against lower stop 45 to its raised position against the upper stop 45.

The effect upon the toggle assembly is the same when, instead of an increase in the pressure within bellows 22, there is a decrease in the pressure. The corresponding motion of L-shaped lever 24 is transmitted through link 31 to lever 33 so that the latter is rotated counterclockwise, as viewed, thereby raising link 37 and lowering link 34. Upward displacement of link 37 is transmitted through pin 38 to main operating link 36 to rotate the latter clockwise about its pivot 39. It will be noted that slot 34' formed in link 34 prevents link 34 from interfering with this rotation of link 36. As lever 33 is restored to its normal position, link 36, under the influence of spring 42, rotates counterclockwise to its normal position.

As shown in Figures 2 and 3 toggle 43 is connected to one end of a rod 50 which provides an interconnection with a conventional spring driven clockwork transmitter 51 controlled thereby. A projection 52 adjacent the lower end of rod 50 rides in an annular groove 54 formed in one face of gear wheel 55. As shown, projection 52 is seated in a notch 53 opening radially inward from groove 54. Gear wheel 55 is biased by means of a spring 56 so as to rotate clockwise when free. A conventional escapement movement is provided including an escapement pawl 57 and a suitable gear train of which only the escapement star wheel 58 is shown rotation of which is controlled by pawl 57.

Gear wheel 55 meshes with a smaller spur gear 60 fixed to shaft 61 on which code wheel 62 is mounted. Gear wheel 55 and spur gear 60 are in the ratio of 6 to 1 in the present instance so that rotation of gear wheel 55 through 60° results in one rotation of code

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wheel 62 while rotation of gear wheel 55 through 120° causes two complete rotations of code wheel 62.

Gear wheel 55, in the present embodiment, has three notches in addition to notch 53 formed in its groove 54. A second notch indicated at 63 is formed in the radially inner wall of groove 54 displaced 180° from notch 53. A pair of notches 64 and 65 are formed in the radially outer wall of groove 54 which are mutually spaced from each other at 180°, notch 64 being spaced 120° counterclockwise from notch 53 and notch 65 being similarly located with respect to notch 63. Consequently, when rod 50 is raised due to upward displacement of toggle 43 it is displaceable only until its projection abuts against the outer wall of groove 54. This travel of rod 50 shifts the escapement pins 66 carried thereby to release escapement pawl 57 so that the latter may freely oscillate about its pivot.

The apparatus is put into operation with the desired pressure in the sprinkler system, toggle assembly 40 in its normal position against lower stop 45 and projection 52 seated in either notch 53 or notch 63. Assuming that projection 52 is seated in notch 53 and the pressure departs in either direction from the desired value, toggle assembly 40 is shifted toward upper stop 45 raising rod 50 and thereby freeing escapement pawl 57. Gear wheel 55 is now free to rotate under the influence of spring motor 56 until it has rotated through 120° thereby carrying notch 64 into registration with projection 52 on rod 50. Spring 42 acting through toggle 43 urges rod 50 upward to seat its projection 52 in groove 64. This upward motion of rod 50 raises the lower escapement pin 66 into the path of the escapement pawl 57 so that oscillation of the latter is interrupted and thereby arresting rotation of gear wheel 55. This rotation of gear wheel 55 results in two complete revolutions of code wheel 62 during which the distinctive tooth pattern of code wheel 62 opens and closes the contacts of switch 67, the latter being connected through conductors 68 to a suitable receiver located at the distant central station.

Restoration of the pressure within the sprinkler system results in spring 42 of the toggle assembly 40 being biased in the direction to return toggle 43 to its normal condition that is, towards the lower stop 45. Thus, rod 50 is free to shift downward and carry its projection 52 out of notch 64, downward motion of rod 50 being interrupted when projection 52 butts against the radially inner wall of groove 54. Gear wheel 55 is now free to rotate until notch 63 registers with projection 52. When the projection 52 seats in notch 63 the upper escapement pin 66 is once again in position to prevent oscillation of pawl 57 and rotation of gear wheel 55 is again stopped. While gear wheel 55 rotates through the arc between notches 64 and 63, code wheel 62 makes one full revolution and intermittently interrupts the circuit closed by switch 67. Thus a two-round signal corresponding to two revolutions of code wheel 62 is transmitted whenever the pressure in the sprinkler system departs by a predetermined amount from the preset value. When the preset pressure value is restored, a one round signal corresponding to one revolution of code wheel 62 is transmitted.

The present apparatus may be utilized to supervise a wide range of pressures by suitably adjusting screw 49 to more or less compress spring 26 without disturbing the amount of pressure change to which the system is sensitive. It will be readily appreciated that the sensitivity of the apparatus to a departure of the supervised pressure from the selected value depends upon the resistance required to be overcome by the pressure in initiating a displacement of the toggle assembly 40 from its lower stop 45. The apparatus readily lends itself to different uses wherein relatively widely different degrees of sensitivity may be required. For example, by suitably selecting spring 42, a greater or smaller change in the

pressure within the supervised apparatus will be required to cause displacement of the toggle assembly.

The terms and expressions which have been employed are used as terms of description and not of limitation, and there is no intention, in the use of such terms and expressions of excluding any equivalents of the features shown and described or portions thereof, but it is recognized that various modifications are possible within the scope of the invention claimed.

I claim:

1. In a pressure responsive supervisory signaling means for providing distinctive signals upon departure of the pressure in an apparatus from a predetermined value and upon restoration of the pressure to said value, pressure responsive means adapted to be coupled to said apparatus and including a member displaceable from a predetermined position in one direction corresponding to an increase in the pressure in said apparatus from said predetermined value and in another direction corresponding to a decrease in the pressure in said apparatus from said predetermined value, signaling means adapted to transmit two mutually distinctive signals, a toggle mounted for limited displacement between two extreme positions, control means responsive to said toggle and maintaining said signaling means inoperative to transmit when said toggle is in either one of its extreme positions and releasing said signaling means to transmit one of said signals when said toggle is displaced from one of its extreme positions and to transmit the other of said signals when said toggle is displaced from the other of its extreme positions, means normally urging said toggle toward its said one extreme position, and means responsive to displacement of said member from its said predetermined position in said one direction and in said other direction for biasing said toggle toward the other of its extreme positions.

2. In a pressure responsive supervisory signaling means for providing distinctive signals upon departure of the pressure in an apparatus from a predetermined value and upon restoration of the pressure to said value, a first lever mounted for rotation through an arc, means for coupling said first lever to said apparatus whereby said first lever is rotated through an arc from a predetermined position in one direction and to an extent corresponding to the amount by which the pressure in said apparatus increases from said predetermined value and in the opposite direction to an extent corresponding to the amount by which the pressure in said apparatus decreases from said predetermined value, signaling means adapted to transmit two mutually distinctive signals, a toggle mounted for limited displacement between two extreme positions, control means responsive to said toggle and maintaining said signaling means inoperative to transmit when said toggle is in either one of its extreme positions and releasing said signaling means to transmit one of said signals when said toggle is displaced from one of its extreme positions and to transmit the other of said signals when said toggle is displaced from the other of its extreme positions, means normally urging said toggle toward its said one extreme position, and means responsive to rotation of said first lever from its said predetermined position in said one direction and in said opposite direction for biasing said toggle toward the other of its extreme positions.

3. In a pressure responsive supervisory signaling means for providing distinctive signals upon departure of the pressure in an apparatus from a predetermined value and upon restoration of the pressure to said value, a first lever mounted for rotation through an arc, means for coupling said first lever to said apparatus whereby said first lever is rotated through an arc from a predetermined position in a direction and to an extent corresponding to the direction and amount by which the pressure in said apparatus departs from said predetermined value, signaling means adapted to transmit two mutually dis-

tinctive signals, a toggle mounted for limited displacement between two extreme positions, control means responsive to said toggle and maintaining said signaling means inoperative to transmit when said toggle is in either one of its extreme positions and releasing said signaling means to transmit one of said signals when said toggle is displaced from one of its extreme positions and to transmit the other of said signals when said toggle is displaced from the other of its extreme positions, means normally urging said toggle toward its said one extreme position, a pivotally mounted link, means connected to said first lever for rotating said link in only one direction as said first lever departs from said predetermined position and leaving said link free to rotate in the opposite direction as said first lever returns to said predetermined position, and resilient means connected to said link and to said toggle for biasing the latter toward the other of its extreme positions when said link is rotated in said one direction.

4. In a pressure responsive supervisory signaling means for providing distinctive signals upon departure of the pressure in an apparatus from a predetermined value and upon restoration of the pressure to said value, a first lever mounted intermediate its ends for rotation through an arc, means for coupling said first lever to said apparatus whereby said first lever is rotated through an arc from a predetermined position in a direction and to an extent corresponding to the direction and amount by which the pressure in said apparatus departs from said predetermined value, signaling means adapted to transmit two mutually distinctive signals, a toggle mounted for limited displacement between two extreme positions, control means responsive to said toggle and maintaining said signaling means inoperative to transmit when said toggle is in either one of its extreme positions and releasing said signaling means to transmit one of said signals when said toggle is displaced from one of its extreme positions and to transmit the other of said signals when said toggle is displaced from the other of its extreme positions, means normally urging said toggle toward its said one extreme position, a pivotally mounted link, a pair of second levers one connected to each of the ends of said first lever and engaging said link for rotating the same in only one direction as and independent of the direction in which said first lever departs from said predetermined position and leaving said link free to rotate in the opposite direction as said first lever returns to said predetermined position, and resilient means connected to said link and to said toggle for biasing the latter toward the other of its extreme positions when said link is rotated in said one direction.

5. In a pressure responsive supervisory signaling means for providing distinctive signals upon departure of the pressure in an apparatus from a predetermined value and upon restoration of the pressure to said value, a first lever mounted intermediate its ends for rotation through an arc, means for coupling said first lever to said apparatus whereby said first lever is rotated through an arc from a predetermined position in a direction and to an extent corresponding to the direction and amount by which the pressure in said apparatus departs from said predetermined value, signaling means adapted to transmit two mutually distinctive signals, a toggle mounted for limited displacement between two extreme positions, control means responsive to said toggle and maintaining said signaling means inoperative to transmit when said toggle is in either one of its extreme positions and releasing said signaling means to transmit one of said signals when said toggle is displaced from one of its extreme positions and to transmit the other of said signals when said toggle is displaced from the other of its extreme positions, said control means including a gear wheel connected to said signaling means and having an annular groove formed in one surface thereof and at least two notches spaced along and formed in the opposite walls of said groove, a rod connected to and movable with said toggle and ex-

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tending into said groove, means normally urging said toggle toward its said one extreme position, a pivotally mounted link, a pair of second levers one connected to each of the ends of said first lever and engaging said link for rotating the same in only one direction as and independent of the direction in which said first lever departs from said predetermined position and leaving said link free to rotate in the opposite direction as said first lever returns to said predetermined position, resilient means connected to said link and to said toggle for biasing the latter toward the other of its extreme positions when said link is rotated in said one direction, said rod having a projection normally seating in one of said notches when said toggle is in its said one extreme position and said

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projection seating in the other of said notches when said toggle is in the other of its extreme positions.

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