

Jan. 12, 1965

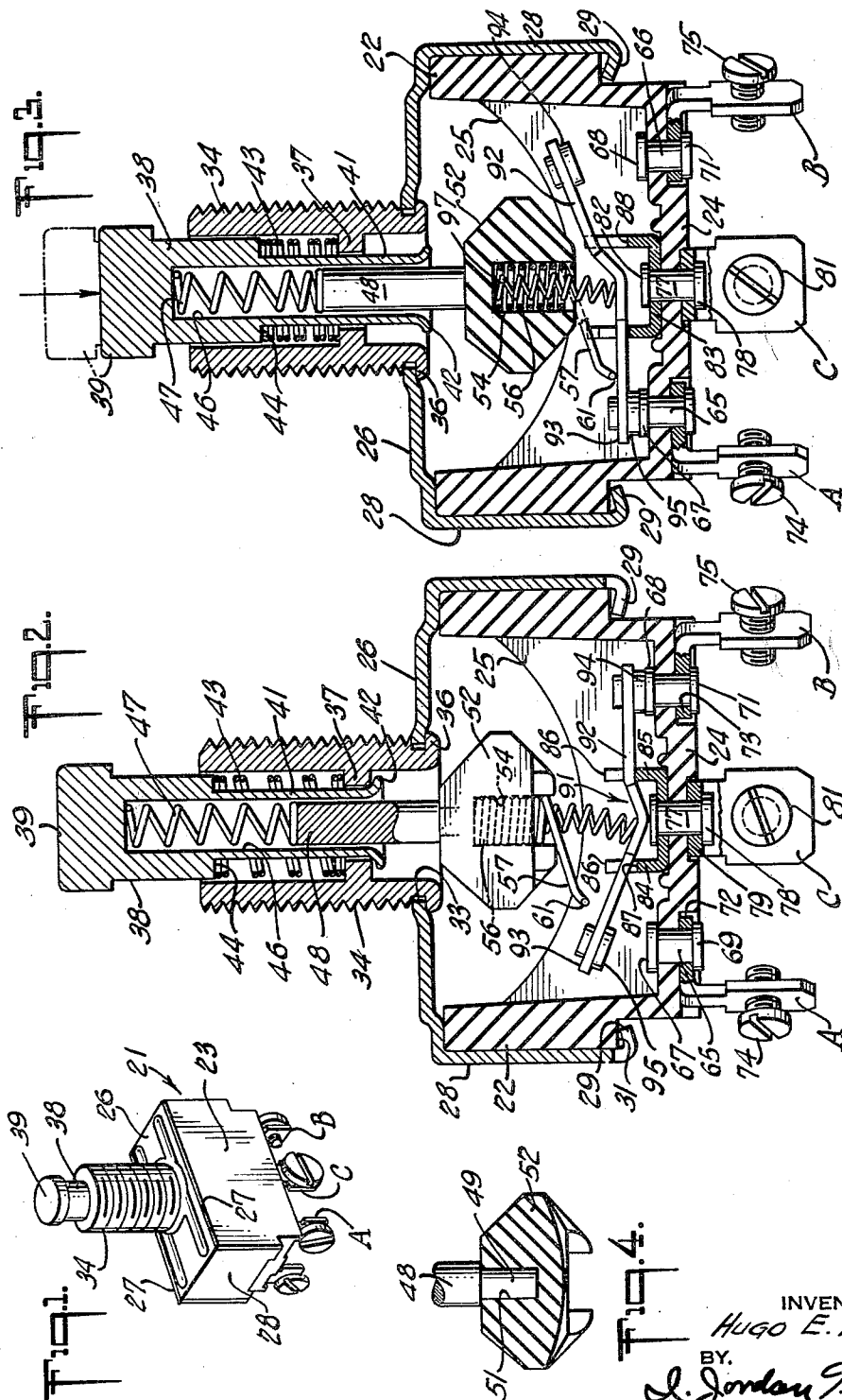
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3,165,611

SPRING BIASED-SPRING ACTUATED MOMENTARY SWITCH

Filed July 18, 1961

2 Sheets-Sheet 1



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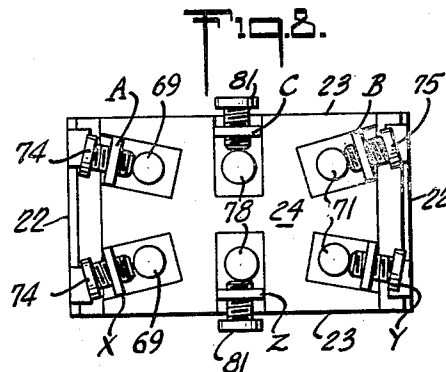
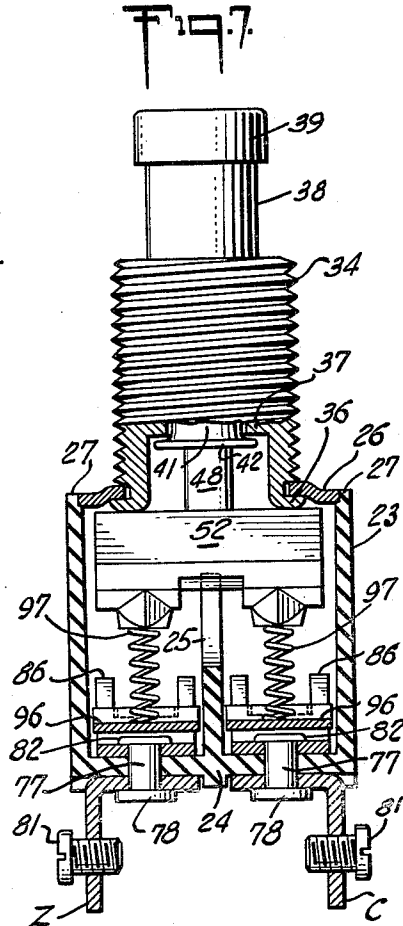
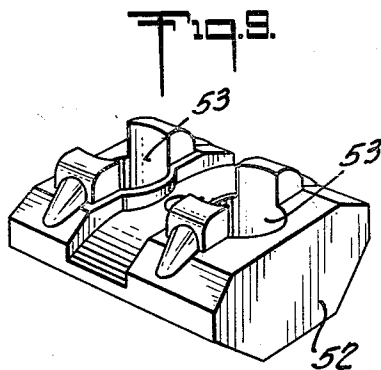
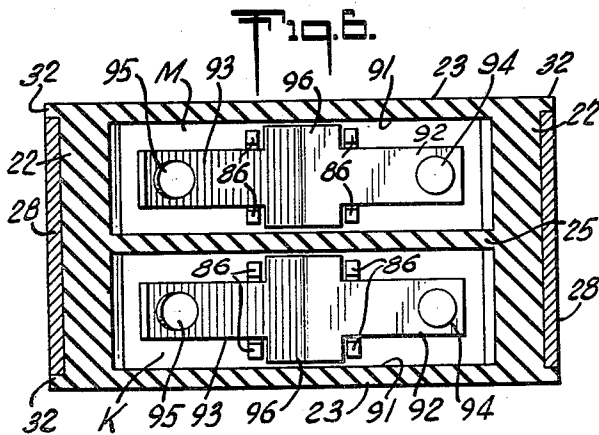
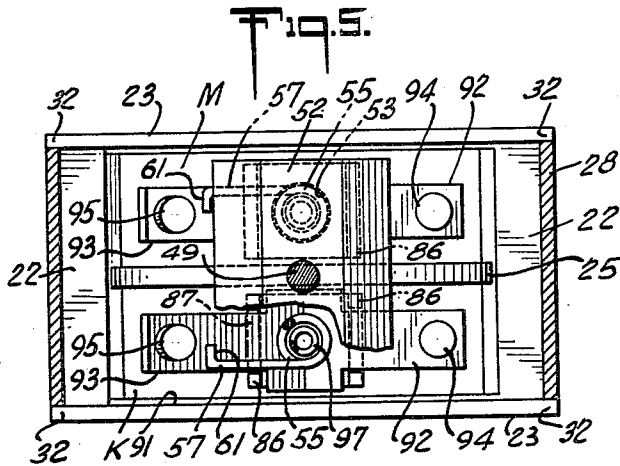
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2 Sheets-Sheet 2



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SPRING BIASED-SPRING ACTUATED MOMENTARY SWITCH

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Filed July 18, 1961, Ser. No. 126,837

2 Claims. (Cl. 200—159)

This invention relates to electric switches, and more particularly to a momentary plunger type electric switch which, by suitable utilization of its terminal lugs, may be employed as a double-pole double-throw switch; single-pole double-throw switch; double-pole single-throw, normally open switch; and a double-pole single-throw normally closed switch.

A salient feature of the present invention is the provision of an actuator element which is maintained in a floating counterbalanced position between the plunger and one or more contact levers which are each adapted alternately to make contact with either of a pair of spaced apart circuit elements. This is accomplished by an override spring positioned between the plunger and one side of the actuator while a stabilizing spring is provided between each contact lever and the other side of said actuator. The stabilizing spring normally maintains said lever in contact with one of the circuit elements while momentary pressure upon the plunger causes the actuator or an element on said actuator to move the lever pivotally to bring it into contact with the other only of said pair of circuit elements. Since the electrically conductive contact lever is pivotally mounted upon an electrically conductive yoke intermediate said two circuit elements, the connection of said yoke to a circuit common to both of said circuit elements provides for the selective reciprocal closing and opening by each lever of two separate electrical circuits.

A return spring is provided to maintain the plunger in a normally retracted position. When momentary pressure is applied to the plunger, the equilibrium of the actuator between the override spring and the stabilizing spring or springs is shifted whereby the actuator is moved into a position where it causes the pivoting action of the contact lever or levers. When pressure is released from the plunger, the latter returns to its retracted position and the counterbalanced actuator returns to its original position of equilibrium, thereby permitting the return of the contact lever to its original position.

Still other objects and advantages of the invention will be apparent from the specification.

The features of novelty which are believed to be characteristic of the invention are set forth herein and will best be understood, both as to their fundamental principles and as to their particular embodiments, by reference to the specification and accompanying drawing, in which:

FIGURE 1 is a perspective view of the switch of the present invention;

FIG. 2 is a greatly enlarged section view, taken on line 2—2 of FIG. 1, some parts being shown in elevation and some parts in dotted outline, and illustrating the "at rest" or normal position;

FIG. 3 is similar to FIG. 2, and shows the arrangement of the switch mechanisms when the plunger has been depressed, the section view line of the yoke portion being spaced apart laterally from the section line of the remainder of said figure;

FIG. 4 is a fragmentary central section view of the yoke portion of the switch shown in FIGS. 2 and 3;

FIG. 5 is a view, taken on line 5—5 of FIG. 2, some parts being omitted and some parts being broken away;

FIG. 6 is a view taken on line 6—6 of FIG. 2, some parts being omitted;

FIG. 7 is a view, partly in elevation, taken on line 7—7 of FIG. 2, some parts being omitted;

FIG. 8 is a bottom view of the switch shown in FIGS. 2 and 3, somewhat reduced in size; and

FIG. 9 is a bottom perspective view, greatly enlarged, of the actuator yoke shown in FIGS. 2, 3, and 4.

Referring now to the drawings in detail, the switch of the present invention comprises a box-like molded case, generally designated 21, made of a suitable insulating material, such as synthetic resin, Bakelite, or the like, and having a pair of opposing end walls 22 and a pair of side walls 23. The bottom of case 21 is enclosed by a floor 24.

Positioned intermediate side walls 23 of case 21 is a longitudinal partition 25 integrally molded in said case and dividing the interior thereof into two compartments K and M (FIGS. 2 to 7). The top edge of partition 25 is arcuate in form in order to accommodate the action of some of the switch parts, as will be described hereinafter. Each compartment K and M contain substantially identical switching elements.

The open top of case 21 is enclosed by a cover bracket 26, made of sheet metal, or the like. Bracket 26 is maintained in position on the top of case 21 by means of a pair of spaced apart longitudinal rails 27 molded integrally at the top of respective walls 23 (FIGS. 1 and 7). Each opposite end of bracket 26 has a downwardly extending integral leaf 28 which terminates in a pair of spaced apart clamping fingers 29, each of which engage respective shoulders 31 in end walls 22 to secure bracket 26 firmly in position on case 21. Each end wall 22 has a pair of integral spaced apart parallel rails 32 which serve to locate said leaves 28 in proper position.

Bracket 26 has a central aperture 33 which accommodates the lower end portion of an upwardly extending threaded tubular stem 34. The bottom of stem 34 has a terminal flange 36 which is spun around the bottom of bracket 26 in the area surrounding aperture 33 to secure said stem firmly to said bracket. Stem 34 may otherwise be attached to bracket 26 by force fit or other suitable means.

On the interior of stem 34, intermediate the ends thereof, is an integral inwardly extending annular collar 37. Movable longitudinally within stem 34 is a tubular plunger 38 having a button 39 integrally formed at the top thereof. The lower portion of plunger 38 is reduced in diameter in the form of tube 41, the lower end of which terminates in an outwardly flaring annular flange 42. Positioned coaxially between tube 41 and stem 34 is a double strand coiled spring 43, one end of which bears against the top of collar 37, the other end of which bears against shoulder 44 formed between the plunger 38 and its lower tubular portion 41. Spring 43 normally urges plunger 38 upwardly, the movement of the latter being limited by flange 42 of tube 41 bearing against the bottom of collar 37 (FIGS. 2, 7).

Plunger 38 and tube 41 have a common axial longitudinal recess 46 which accommodates a captive coiled spring 47, one end of which bears against the inner end of said recess, the other end of which bears against the top of a pin 48, movable longitudinally within the interior of tube 41. The lower end of pin 48 terminates in a nib 49 of reduced diameter (FIG. 4).

Nib 49 cooperates removably with a mating recess 51 in the top of an actuator yoke 52 made of a suitable insulating material such as Bakelite, plastic, or the like. The bottom of actuator yoke 52 has a pair of spaced apart, upwardly extending recesses 53, each of said recesses accommodating the coil of a resilient torsion spring 55. Torsion springs 55 have downwardly and obliquely extending arms 57 which terminate in laterally extending fingers 61, respectively. Torsion springs 55

are secured firmly in their respective recesses 53 by frictional engagement with the walls thereof.

Positioned in floor 24 within each compartment K and M, is a pair of spaced apart electrically conductive studs 65 and 66 which extend through said floor and are secured therein by means of molding or the like. Stud 65 and 66 have integral contact heads 67 and 68, respectively, extending into the interiors of compartments K and M.

The lower ends of said studs extending beyond the bottom surface of floor 24 have rivet heads 69 and 71, respectively, which firmly secure electrically conductive brackets 72 and 73 to the bottom of said case. Brackets 72 and 73 have downwardly extending electrically conductive lugs A and B, and X and Y, respectively, which serve as terminals to which separate electrical circuits are connectible by means of screws 74 and 75.

Positioned intermediate each pair of studs 65 and 66 is an electrically conductive stud 77 which also extends through floor 24 and is incorporated securely therein by means of molding or the like. The lower end of each stud 77 on the exterior of case 21 has a rivet head 73 which firmly secures an electrically conductive bracket 79 to the bottom of the case. Brackets 79 have downwardly extending lugs C and Z, respectively, which serve as terminals to which electrical circuits common to those of lugs A, B, X and Y, are connectible by means of screw 81.

The upper end of each stud 77 in the interior of case 21 has an integral rivet head 82 which secures the base of an electrically conductive support yoke 83 firmly to floor 24. Formed integrally with the base of each support yoke 83 is a pair of spaced apart, upwardly extending arms 84 and 85, each of which terminates in a pair of spaced apart fingers 86. Formed between pairs of fingers are respective shoulders 87 and 88 which serve as double fulcrums for a pivotable electrically conductive V-shaped circuit contact lever, generally designated 91. Circuit lever 91 has a pair of arms 92 and 93 extending in opposite directions and arrayed at an angle relative to each other. Connected to the outer end portion of lever arm 92 is a contact button 94 which, upon pivoting action of lever 91, makes and breaks an electrical circuit in respect of contact head 68.

Connected to the outer end portion of lever arm 93 is a contact button 95 which, upon pivoting action of lever 91, makes or breaks an electrical circuit in respect of contact head 67 (FIGS. 2 and 3). The central portion of each lever 91 has a pair of integral oppositely extending wings 96 which serve to stabilize said lever between pairs of fingers 86 on shoulders 87 and 88 of yoke 83 (FIG. 6).

Each lever 91 is normally maintained balanced in position upon both shoulders 87 and 88 by means of stabilizing coil springs 97, a portion of which extends coaxially through the interior of a respective torsion spring 56 and with its end bearing against the interior end of recess 54, the other end of spring 97 bearing down upon the central V-shaped portion of lever 91. Override spring 47 also serves to maintain downward pressure upon yoke 52 which is transmitted to springs 97. In the normal position of the switch mechanism as shown in FIG. 2, the contour of each contact lever 91 is such that contact button 94 on contact arm 92 is in electrical connection with respective contact head 68 of stud 66. In this position of lever 91, contact button 95 on contact arm 93 is spaced apart from and is in the open circuit condition, in respect of contact head 67. In that condition a closed electrical circuit is maintained between studs 66 and 77 and, accordingly, between terminal lugs B and C, and between lugs Y and Z (see FIG. 8).

When downward pressure is applied to push button 39 of plunger 38 (FIG. 3), against the respective actions of override spring 47 and of return spring 43, pin 48 is lowered, thereby causing the descent of actuator yoke 52

into a position where fingers 61 of torsion springs 56 bear downwardly upon contact arms 93 of circuit levers 91, thereby causing the latter to move pivotally into a position where contact buttons 95 are brought into electrical connection with contact heads 67 of rivets 65 to close the electrical circuit between studs 65 and 77 and, accordingly, between terminal lugs A and C, and between terminal lugs X and Z. By this action contact buttons 94 of contact arms 92 are moved apart from contact heads 68 of studs 66 to break the electrical circuit between studs 66 and 77 and, accordingly, between terminal lugs B and C, and between terminal lugs Y and Z.

When the pivoting movement of levers 91 from their positions in FIG. 2 to that of FIG. 3 takes place by the action of torsion springs 56, stabilizing springs 97 yield to permit the rise of contact arms 92 and the lowering of contact arms 93. Upon release of push button 39, return spring 43 urges plunger 38 upwardly to its original position, as shown in FIG. 2. Actuator yoke 52 also moves upwardly, retracting fingers 61 of torsion springs 56 from contact arms 93 thereby permitting stabilizing springs 97 pivotally to return levers 91 to their original positions (FIG. 2).

The top edge of partition 25 has a concave profile in order to permit vertical reciprocating movement of actuator yoke 52 (FIGS. 2 and 3).

Levers 91 are normally maintained in a position where buttons 94 are in contact with respective contact heads 68 of studs 66 (FIG. 2) by the combined actions of override spring 47 and of respective stabilizing springs 97. The collective strength of springs 97 is somewhat greater than that of override spring 47 whereby actuator yoke 52 is normally urged upwardly so that fingers 61 of torsion springs 56 are retracted from arms 93 of respective circuit levers 91. When plunger 38 is depressed, the tension of override spring 47 is increased to the extent of exceeding the collective tension of stabilizing springs 97 whereby actuator yoke 52 is lowered (FIG. 3) so that fingers 61 of torsion springs 56 bear downwardly upon arms 93 of respective levers 91. By this action levers 91 are moved pivotally into the position shown in FIG. 3 where buttons 95 come in contact with respective contact heads 67 of studs 65 while buttons 94 become spaced apart from respective contact heads 68 of studs 66.

Furthermore, by means of the opposing forces of override spring 47 and of stabilizing springs 97 under continuing tension, actuator yoke 52 and pin 48 are maintained in interengagement, while springs 97 themselves are maintained in position between actuator yoke 52 and the central portions of respective levers 91, while actuator yoke 52 is in either of its positions as shown in FIGS. 2 and 3. The respective tensions of override spring 47 and of springs 97 are determined so that actuator 52 is maintained in a floating counterbalanced position therebetween in either of its positions shown in FIGS. 2 and 3. Also, by arranging for torsion springs 56 to be lodged in the same recess 54 coaxially with respective stabilizing springs 97, the construction and assembly of the switch parts herein are rendered comparatively simple.

Although the device shown and described herein comprises two sets of switching circuits in compartments K and M, it is understood that the improvements herein are useful for any desired number of sets of circuits using one or a plurality of switch compartments provided actuating yoke 52 is properly dimensioned and has a suitable number of recesses 53 to accommodate a corresponding number of stabilizing springs 97 and torsion springs 56.

While torsion spring 56 has been utilized herein because of the facility in assembling that part into recess 54 of actuator 52, it is contemplated that in some embodiments said spring may be dispensed with and a projecting wire or the like attached directly to an outer portion of said actuator to perform the same function

as arm 57 and finger 61, for producing the pivoting motion of lever 91.

It will be noted that springs 47 and 97 between them maintain actuator 52 in equilibrium in both the retracted position (FIG. 2) and in the depressed position (FIG. 3). Stabilization of actuator 52 in both of those positions is provided by arranging for a portion of pin 48 to be movable longitudinally within aperture 46 of plunger 38 so that said actuator is provided with a rectilinear path of operation.

Depending upon the connection of various circuits to selected terminals of groups A, B, C, and X, Y, Z, the switch shown and described herein is adaptable for different types of switching operations, as follows (FIGS. 2, 3, 8):

(1) Double-pole double-throw: Two circuits are connected to terminals A and B, respectively, and a circuit connected to terminal C common to both A and B; two circuits are connected to terminals X and Y, respectively, and a circuit connected to terminal Z common to both X and Y. According to the position of the switch elements in FIG. 2, the circuits between terminals B, C, and Y, Z, respectively, are normally closed, while the circuits between terminals A, C, and X, Z, respectively, are normally open. When plunger 38 is momentarily depressed (FIG. 3), the circuits between terminals A, C and X, Z, respectively, are momentarily closed, while the circuits between terminals B, C, and Y, Z, respectively, are momentarily opened.

(2) Single-pole double-throw: This form of operation would utilize only one chamber, either K or M, and its corresponding set of terminal lugs, either A, B, C, or X, Y, Z, with normally open and normally closed conditions as described in the previous paragraph.

(3) Double-pole single-throw, normally open: By omitting connections to terminal lugs B and Y, the circuits between lugs A and C and between X and Z are normally open in accordance with the condition of the switch elements in FIG. 2. When plunger 38 is depressed momentarily, the circuits between lugs A and C and between X and Z are momentarily closed (FIG. 3).

(4) Double-pole single-throw, normally closed: By omitting connections to terminal lugs A and X, the circuits between lugs B and C and between Y and Z are normally closed in accordance with the condition of the switch elements in FIG. 2. When plunger 38 is depressed momentarily, the circuits between lugs B and C and between Y and Z become momentarily opened (FIG. 3).

It is claimed:

1. A momentary switch comprising a case made of insulating material, first and second spaced apart circuit elements in said case, an electrically conductive support yoke positioned in said case intermediate said elements,

a V-shaped electrically conductive lever mounted pivotably on said yoke, first and second arms on said lever, a plunger actuator movably mounted in said case, a coil spring, one end of said coil spring being mounted on said actuator, the other end of said coil spring bearing continuously upon the inner apex of said lever and operating continuously and yieldably upon said lever normally to maintain said first arm in contact with said first element, and a second spring on said actuator operative only when the latter is momentarily moved toward said lever to bear directly upon the second arm of said lever to cause the latter to move pivotally on said yoke against the action of said coil spring, said first arm thereby moving momentarily apart from said first element and said second arm moving momentarily into contact with said second element.

2. A momentary switch comprising a case made of insulating material, first and second spaced apart circuit elements in said case, an electrically conductive support yoke positioned in said case intermediate said elements, a V-shaped electrically conductive lever mounted pivotably on said yoke, first and second arms on said lever, a plunger actuator movably mounted in said case, a coil spring, and a torsion spring, one end of each of said springs being mounted coaxially on said actuator, the other end of said coil spring bearing continuously upon said lever during both the retracted and depressed positions of the actuators, the other end of said torsion spring being retracted from said second arm when said actuator is in the retracted position and bearing upon said second arm when said actuator is in the depressed condition, said torsion spring being operative only when the latter is momentarily moved toward said lever to bear directly upon the second arm of said lever to cause the latter to move pivotally on said yoke against the action of said coil spring, said first arm thereby moving momentarily apart from said first element and said second arm moving momentarily into contact with said second element.

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