Jan. 30, 1962 L. H. STITES 3,019,313

SWITCH

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Fig. 1

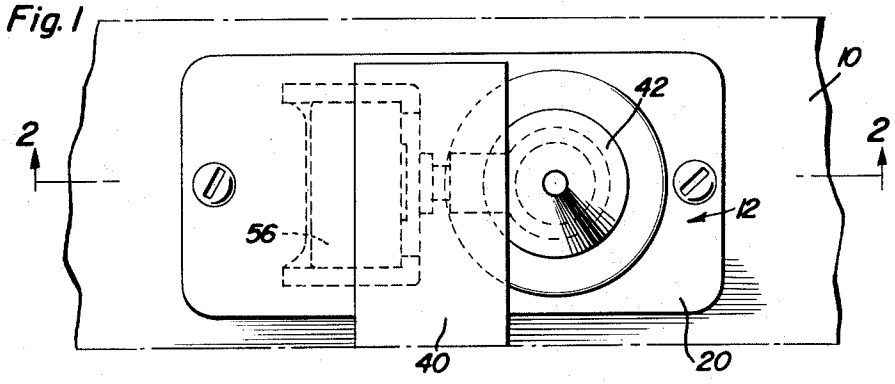


Fig. 2

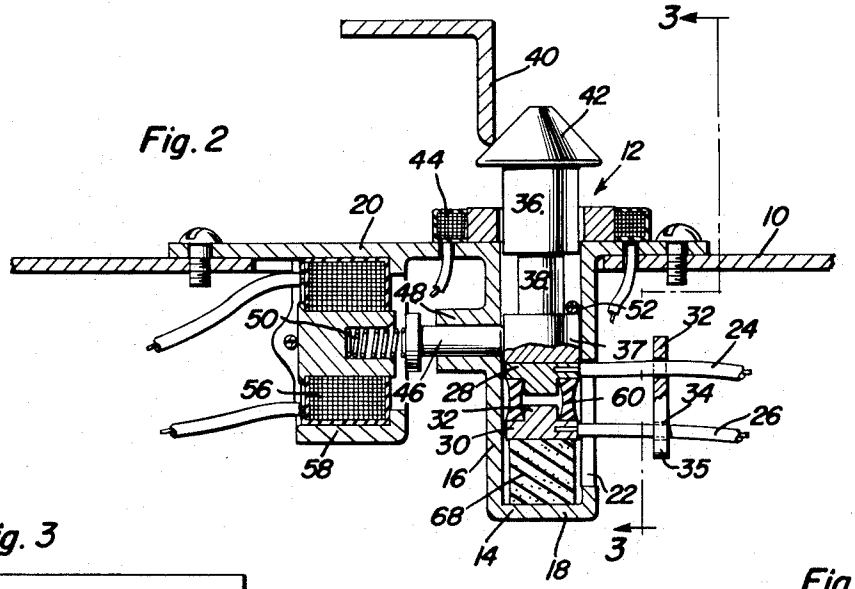


Fig. 3

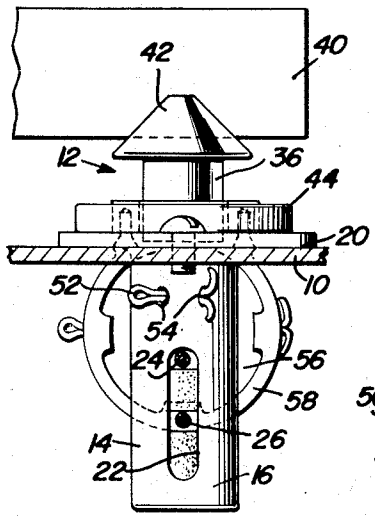


Fig. 4

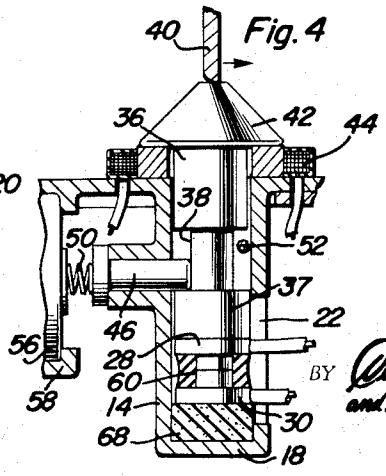
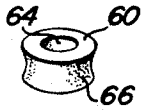


Fig. 5



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Fig. 6

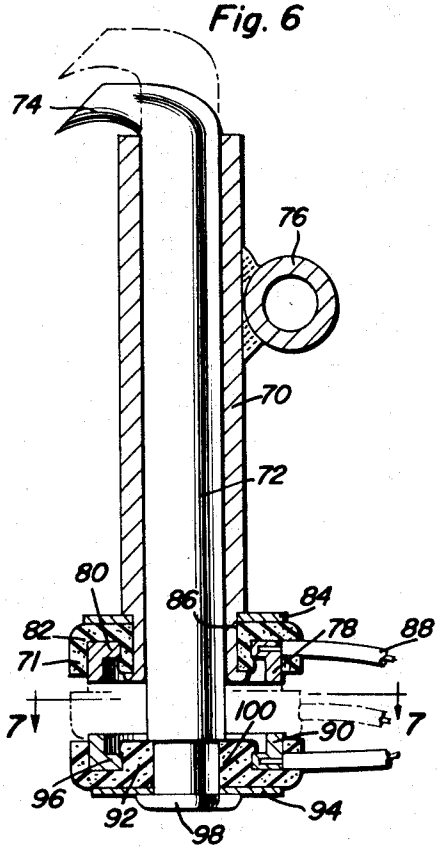


Fig. 8

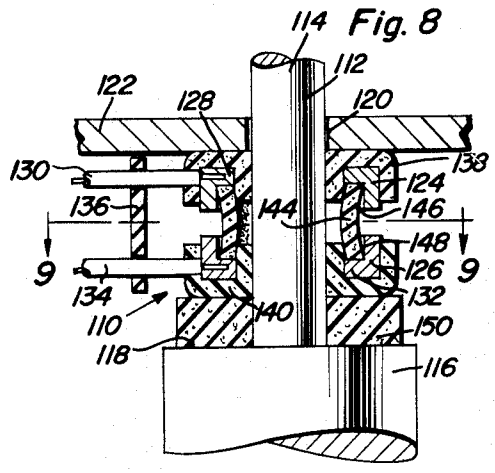


Fig. 9

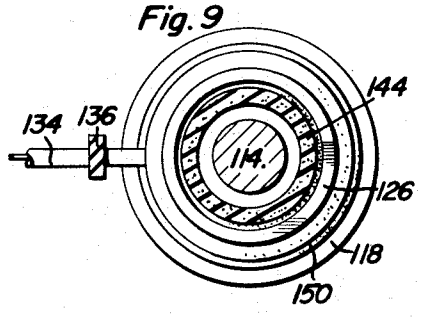


Fig. 7

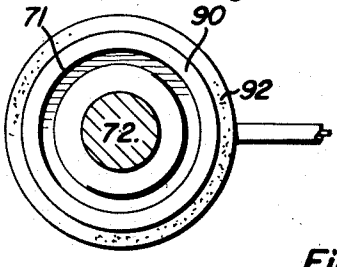


Fig. 10

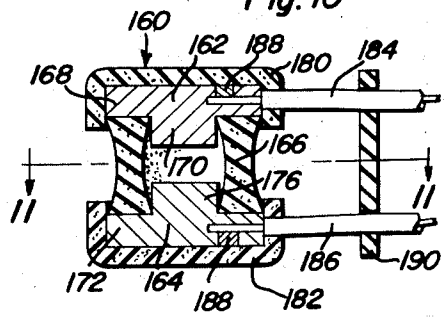
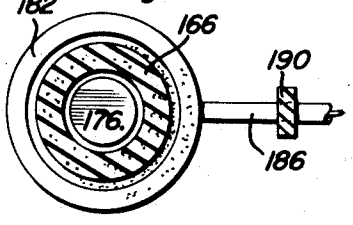


Fig. 11



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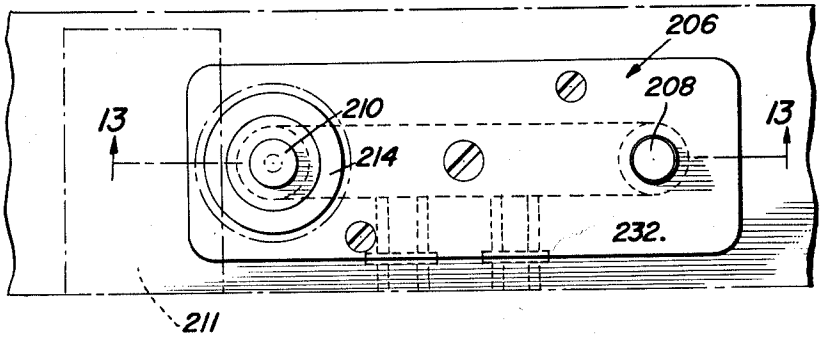
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SWITCH

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Fig. 12



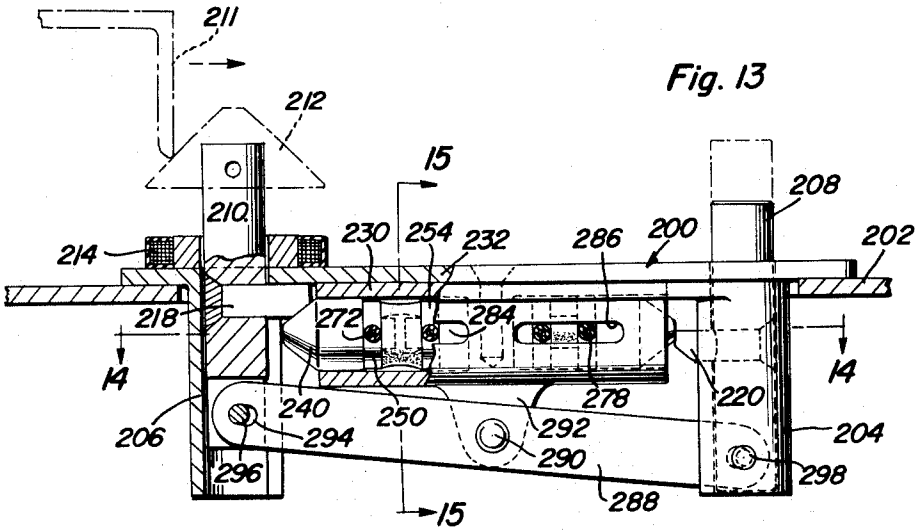


Fig. 13

Fig. 14

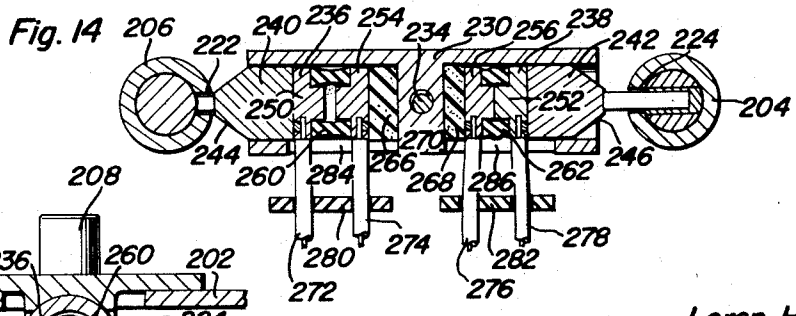


Fig. 15

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Patented Jan. 30, 1962

3,019,313

SWITCH

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Filed Nov. 13, 1958, Ser. No. 773,659
8 Claims. (Cl. 200—87)

This invention relates to switches, and more particularly to improvements in switches which may be used for general purposes or which may be used for special applications.

An object of this invention is to provide improvements in switches enabling the switches to operate considerably more satisfactorily over extended periods with no service, no maintenance and with great dependability.

The invention is embodied in numerous forms of switches which may be used for direct control of an electrical circuit or which may be used in combination with other switches constructed in accordance with this invention or in accordance with conventional design.

One of the important features of this invention is found in the resilient bumper which has a dual purpose. It functions as a spring and also insulates two or more electrically conductive parts, for instance the switch contacts holding them normally spaced but enabling them to be moved together by mechanical, electrical, hydraulic, or any other means. The rubber bumpers are capable of compressing so that the contacts may be brought together thereby closing the switch.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a top view of one of the switches and a switch operator.

FIGURE 2 is a sectional view taken on the line 2—2 of FIGURE 1.

FIGURE 3 is a sectional view taken on the line 3—3 of FIGURE 2.

FIGURE 4 is a sectional view showing the switch in the closed position.

FIGURE 5 is a perspective view of the rubber bumper used in the switch of FIGURE 1.

FIGURE 6 is a longitudinal sectional view of a second switch.

FIGURE 7 is a transverse sectional view taken on the line 7—7 of FIGURE 6.

FIGURE 8 is an enlarged sectional view of another switch.

FIGURE 9 is a sectional view taken on the line 9—9 of FIGURE 8.

FIGURE 10 is a sectional view of a further switch.

FIGURE 11 is a sectional view taken on the line 11—11 of FIGURE 10.

FIGURE 12 is a top view of another switch.

FIGURE 13 is a sectional view taken on the line 13—13 of FIGURE 12.

FIGURE 14 is a sectional view taken on the line 14—14 of FIGURE 13.

FIGURE 15 is a transverse sectional view taken on the line 15—15 of FIGURE 13.

In the accompanying drawings there are a number of switches, each of which is constructed to exemplify the principles of the invention. Reference is first made to FIGURES 1–5 showing a structural support 10 on which switch 12 is mounted. Switch 12 has a switch base 14 which may be made as a tube having side walls 16, a bottom wall, and a flat switch cover 20 at its upper end. There is a slot 22 in side wall 16 to enable conductors 24 and 26 to enter the interior of switch case 14 and connect to the two contacts 28 and 30 of the switch.

Conductors 24 and 26 are passed through apertures 32 and 34 in the insulation panel 35 which may be free, or secured to the switch case, structural support 10 or any other convenient part. Both contacts are located in the switch case 14 and are insulated from it, for instance by a non-conductive sleeve inside case 14 in instances wherein the switch case is made of a conductive material. Contact 30 is made of a disk having a circular contact part 32 at its center. Contact 28 is constructed in the same way but has a switch operator 36 in the form of a spindle or shank, attached to it. The shank has an annular locking recess 38 intermediate its ends. The switch operating shank 38 is made separate from contact 28 and is either of a non-conductive material or has a non-conductive layer between contact 28 and a lower extremity of the switch operator 36.

In instances wherein the switch 12 is to be operated by the movement of a mechanical part 40, e.g. on a machine, conveyor or any other piece of equipment with which the switch is compatible, a head 42 is fixed on the upper extremity of switch operating shank 36. The illustrated head is in the shape of a truncated cone so that it acts as a cam when contacted by the mechanical part 40. If the switch is to be manually operated, head 42 is not necessary. For electromagnetic operation, at least the top part of switch operator 36 is made of a conductor, preferably soft iron, and constitutes the armature of a solenoid in that electromagnetic toroidal coil 44 is positioned around the upper part of the switch operator 36. The electromagnetic coil may be instantaneously energized causing the switch operator 36 to descend with reference to the organization of FIGURE 2, although the switch may be located in any position, that is, horizontal, vertical, or at an angle, and still function with equal success.

Locking recess 38 has bolt 46 located at right angles to it. The bolt is constrained in its travel by sleeve 48 attached to side wall 16 and opening into the cavity of switch case 14. The bolt is in the form of a plunger which bears against the lower enlarged part 37 of the switch operator 36 when the switch is in the open position. When the operator shank 36 is caused to move inwardly of the switch case 14 by any means whatsoever, spring 50 which is seated at one end on bolt 46 pushes the bolt inwardly of switch case 14 and engages the inner end of the bolt in locking recess 38 (FIGURE 4) holding the switch operator in a depressed position. In order to constrain the movement of the switch operator 36, a pin 52, for instance a cotter pin or any other type of pin, is passed through a pair of aligned openings 54 (FIGURE 3) in side wall 16 and through recess 38. Although one pin is illustrated, it is apparent that two may be used should this be found desirable or necessary. Therefore, shank 36 cannot be separated from switch case 14, however, the shank is free to move between the closed and open position, and when closed, it is automatically retained closed by the action of bolt 46 entering locking recess 38.

Bolt 46 may be retracted by any means to serve this purpose. One such means are shown in FIGURE 2 and they are electromagnetic coil 56 carried by coil case 58 that is suitably secured to the switch cover 20.

A very important feature of this invention is composed of rubber bumper 60. Although the bumper is said to be rubber, it may be constructed of any non-conductor having the same or similar properties of rubber. The rubber bumper 60 serves as means for holding the contacts 28 and 30 spaced from each other but enables the contacts to touch when switch operator 36 is moved to the switch closing position inasmuch as the bumper 60 will yield. The bumper 60 is constructed as a collar with a central opening 64 and inwardly curved or straight side

walls 66 (FIGURE 5) both inner and outer. Rubber bumper 68, in the form of a cylindrical, square or any other shape block is disposed on bottom wall 18 of case 14 and has contact 30 seated thereon. Rubber bumper 68 (see FIGURE 4) is compressed when the switch achieves the switch closed position.

Switch 12 may be used as shown in FIGURE 2. Further, only a part of the assembly may be used to actuate another switch that is electromagnetically actuated. In such a case only parts 14, 16, 20, 22, 24, 26, 28, 30, 34, 35, 36, 37, 38, 42, 52, 60 and 68 will be required.

Reference is now made to FIGURES 6 and 7. In this form of the invention the switch 71 is made of a switch case 70 composed of a tube with a switch operating shank 72 mounted therein. A hook 74 is illustrated at one end of shank 72 to show that the switch may be operated when something catches onto the hook and moves the switch operating shank in one direction. Pipe 76 is shown welded to case 70, the pipe 76 diagrammatically representing any suitable mechanical support for the switch.

Switch 71 is a normally open switch, held in the open position by the pull of gravity. Therefore, the switch should be mounted vertical or approximately vertical. The fixed contact 78 of the switch is made of a small collar having an inwardly directed flange 80 inset in a circular collar 82 of electrically insulating material. The collar 82 is U-shaped in cross-section having flange 80 gripped between the sides thereof. Washer 84 is disposed in a recess 86 in the side of the switch, as is sleeve 82 which is gripped tightly by fitting against the side walls of the recess. Conductor 88 is attached, as in all forms of the invention, by any suitable means, for instance by a binding screw, by being soldered, or by solderless connectors and connections.

The movable contact 90 is attached to an insulating sleeve 92 that seats on washer 94. The insulating sleeve 92 is U-shaped in cross-section and grips the inwardly directed flange 96 of the contact 90. There is a head 98 on the lower extremity of shank 72 against which the washer 94 bears. The washer and sleeve 92 are set in a circumferential recess 100 in the lower end of shank 72.

It is evident now that when shank 72 is lifted the contacts 78 and 90 will be brought together into the closed position. The lifting of shank 72 may be achieved by a part engaging hook 74 or any other element for moving the shank. Alternatively, an electromagnetic coil may be placed at the hook 74 end of shank 72 to operate the switch.

Attention is now invited to FIGURES 8 and 9. Switch 110 is illustrative in these figures. The switch has an operating shank 112 with a reduced part 114 and an enlarged part 116 separated by shoulder 118. The reduced part 114 of shank 112 is passed through an opening 120 in a structural support 122 for the switch.

Switch 110 has two contacts 124 and 126, each being identical and composed of a collar having an inwardly directed flange. The flange 128 of contact 124 has a conductor 130 attached to it, while flange 132 of contact 126 has a conductor 134 attached to it. Both conductors are passed through openings in an insulating panel 136 which, as in the embodiment of FIGURE 1, may be attached to any suitable structural support or may remain free floating and thereby serving a spacing function for the conductors 130 and 134.

Contact 124 is set in a circular insulating sleeve 138 which is U-shaped in cross section thereby forming a pocket within which the contact 124 is embraced. Identical sleeve 140 holds contact 126, and the sleeves and contacts are each provided with central openings enabling the switch operating shank 112 to pass therethrough. The switch 110 is a normally open switch, held open by rubber bumper 144. The rubber bumper is in the form of a sleeve with concavo-convex or straight walls whatever is best suitable to manufacture walls whose edges are located in the confronting recesses 146 and 148 formed between

part of sleeves 138, 140 and contacts 124, 126. The bumper holds the contacts spaced apart but is capable of yielding so that the adjacent surfaces of the contacts may touch when the switch is moved to the closed position. Rubber bumper 150 has a central opening through which shank 112 passes and it is located on shoulder 118. The sleeve 140 seats on bumper 150. Both of the bumpers yield when the switch operating shank 112 is moved to the switch closing position. The movement of shank 112 may be achieved either hydraulically, mechanically or electrically.

FIGURES 10 and 11 illustrate another embodiment of the invention. In these figures there is a switch 160 which has a pair of contacts 162 and 164. This, is perhaps, the simplest form of switch using rubber bumper 166 which is identical to rubber bumper 60 (FIGURE 5). Contact 162 is composed of a disk 168 having a smaller diameter disk 170 integral therewith. The other contact 164 has a disk 172 with a smaller diameter disk 176 integral. Two smaller disks 170 and 176 are adapted to be brought together to the switch closing position with rubber bumper 166 yielding in compression to enable the surface of the contacts to touch. The inherent elasticity of the bumper 166 will return the contacts to the switch open position.

Sleeves 180 and 182, preferably made of a non-conductor, have end walls to form a pair of cups within which the contacts 162 and 164 are supported. There are openings in the side walls of the sleeves to enable conductors 184 and 186 to enter openings in the contacts and be soldered as at 188 or otherwise fastened in place. The conductors are passed through spaced openings in insulating panel 190, this being identical to the previously mentioned panels that are associated with the other conductors of the other switch.

FIGURES 12–15 show a more complicated switch arrangement. However, the switch 200 in FIGURES 12–15 is very much like switch 12 in a number of respects. As shown in FIGURES 13 and 14 the switch 200 is mounted on a structural support 202 and has a pair of identical switch cases 204 and 206 within which switch operating shanks 208 and 210 are mounted for reciprocation. In instances wherein the switch is to be operated by the movement of a mechanical part 210, the head 212, identical to head 42, is attached to the upper extremity of shank 210. Here again the switch may be electromagnetically operated by using a toroidal coil 214 placed around the shank 210 whereby the shank 210 will be drawn to the down position. Furthermore, switch 200 may be manually operated.

Each shank has a pin secured to it and protruding laterally therefrom. The shank 210 has pin 218 and the shank 208 has pin 220, the pins extending through slots 222 and 224 in cases 206 and 204.

Switch case 230 is attached to switch cover 232, for instance by one or more screws or bolts 234. The switch case has two switch sections 236 and 238, each of which is identical. Shanks 240 and 242 are mounted for sliding movement in the switch case 230 and have cam surfaces 244 and 246 that are engaged by pins 218 and 220, each of these having a cam surface. Shank 240 engages a surface of contact 250 while shank 242 engages a surface of contact 252. Contacts 254 cooperates with contact 250 and contacts 256 cooperates with contact 252 to obtain the switching function. Rubber bumpers 260 and 262 respectively are located between the pairs of contacts and the rubber bumpers are identical to the rubber bumper that has been described in detail elsewhere. Rubber bumpers 266 and 268 contact the dividing wall 270 in case 230 and the innermost contacts 254 and 256 respectively of the two switch sections.

Conductors 272, 274, 276 and 278 respectively are passed through openings in panels 280 and 282 and are attached to the individual contacts 250, 254, 256 and 252. In order to enter the switch case 230 there are slots 284

and **286** in the switch case side wall. A three-way switch may be made of this embodiment of the invention by tying together conductors **274** and **276** and using the conductors **272** and **278** as the second and third conductors in the two-way switch arrangement.

A rocker arm **288** is mounted for pivotal movement on pin **290** suspended from beneath case **230** on bracket **292**. The ends of the rocker have slots **294** through which pins **296** and **298** are passed, these pins being carried by the bifurcated lower ends of shanks **210** and **208**. It is evident from inspection of FIGURE 13 that when shank **210** is raised, shank **208** will automatically lift and vice versa. This alternately opens and closes the switch sections **236** and **238** with the rubber bumpers functioning in a manner described previously in connection with the other rubber bumper in the other embodiments of the invention.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. A switch comprising a switch case, a shank movable in said switch case, a first contact having a reduced terminal portion disposed in said switch case, a second contact having a reduced terminal portion disposed in said switch case, an annular resilient insulating bumper defining a central opening located between and in engagement with said contacts and holding said contacts spaced apart, said reduced terminal portions extending toward each other in said central opening said bumper being compressible so that said contacts may be brought together and touch in said central opening, a second rubber bumper located in said switch case and having said second contact seated thereon, said second bumper also compressible when said contacts are moved to a switch closed position, said shank being movable to the switch closed position so as to engage one of the contacts and force it into engagement with the other contact.

2. A switch comprising a switch case, a shank movable in said switch case and having a locking recess, a first contact having a reduced terminal portion disposed in said switch case, a second contact having a reduced terminal portion disposed in said switch case, an annular resilient insulating bumper defining a central opening located between and in engagement with said contacts and holding said contacts spaced apart, said reduced terminal portions extending toward each other in said central opening said bumper being compressible so that said contacts may be brought together and touch in said central opening, a second rubber bumper located in said switch case and having said second contact seated thereon, said second bumper also compressible when said contacts are moved to a switch closed position, said shank being movable to the switch closed position so as to engage one of the contacts and force it into engagement with the other contact, a locking bolt carried by said switch case and adapted to enter said locking recess when said shank is moved to the switch closed position, means for withdrawing said locking bolt from said locking recess.

3. A switch comprising a switch case, a shank movable in said switch case and having a locking recess, a first contact having a reduced terminal portion disposed in said switch case, a second contact having a reduced terminal portion disposed in said switch case, an annular resilient insulating bumper defining a central opening located between and in engagement with said contacts and holding said contacts spaced apart, said reduced terminal portions extending toward each other in said central opening said bumper being compressible so that said contacts may be brought together and touch in said central opening, a second rubber bumper located in said switch case and having said second contact seated thereon, said second bumper also compressible when said contacts are moved to a switch closed position, and means connected with said shank for moving said shank in a direction to bring said contacts together.

4. A switch comprising a switch case, a shank movable in said switch case and having a locking recess, a first contact having a reduced terminal portion disposed in said switch case, a second contact having a reduced terminal portion disposed in said switch case, an annular resilient insulating bumper defining a central opening located between and in engagement with said contacts and holding said contacts spaced apart, said reduced terminal portions extending toward each other in said central opening said bumper being compressible so that said contacts may be brought together and touch in said central opening, a second rubber bumper located in said switch case and having said second contact seated thereon, said second bumper also compressible when said contacts are moved to a switch closed position, said shank being movable to the switch closed position so as to engage one of the contacts and force it into engagement with the other contact, a locking bolt carried by said switch case and adapted to enter said locking recess when said shank is moved to the switch closed position, means for withdrawing said locking bolt from said locking recess, said bolt withdrawing means comprising an electromagnetic coil, a spring reacting on said locking bolt and applying a force on said locking bolt in a direction to move said locking bolt into said locking recess.

5. A switch comprising a switch casing, a shank movable in said switch casing, a first contact having a reduced terminal portion disposed in said switch case, a second contact having a reduced terminal portion disposed in said switch case, an annular resilient insulating bumper defining a central opening located between and in engagement with said contacts and holding said contacts spaced apart, said reduced terminal portion extending toward each other in said central opening, said bumper being compressible so that said contacts may be brought together and touch in said central opening, and said shank being operatively engaged with at least one of said contacts so that when it moves in said casing it causes said contacts to touch.

6. A device as defined in claim 5 wherein said shank and said contacts are in alignment with one another, and said shank and said one contact normally moving together and in the same direction.

7. A device as defined in claim 5 wherein said shank moves in a direction transverse to the direction of movement of said one contact, and said shank includes a cam means operatively engaged with a cooperating surface on said one contact for moving same.

8. A device as defined in claim 5 wherein said casing includes a third contact and a fourth contact, a second annular resilient bumper defining a central opening located between and in engagement with said third and fourth contacts, said third and fourth contacts having reduced portions extending toward each other in said central opening, a second shank generally parallel to and spaced from said first-mentioned shank, said second shank being operatively engaged with one of said third and fourth contacts for forcing them together, and means operatively connecting said shanks whereby the movement of one will cause the other to move in a reverse direction for alternately closing said first and second contacts and said third and fourth contacts.

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