United States Patent [19]

Raab et al.

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[45] Feb. 5, 1974

[54] **ALTERNATE ACTION SWITCH WITH SEALING BOOT GIVING VISUAL INDICATION OF SWITCH POSITION**

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[73] Assignee: **Indak Manufacturing Corp.**, Northbrook, Ill.

[22] Filed: **Nov. 12, 1971**

[21] Appl. No.: **198,328**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 73,295, Sept. 18, 1970, abandoned.

[52] **U.S. Cl.**..... **200/168 G**, 200/153 J, 200/167 R

[51] **Int. Cl.**.... **H01h 13/06**, H01h 13/56, H01h 9/16

[58] **Field of Search** 200/168 G, 153 J, 16 A, 159 R, 200/159 B, 169 PB, 167 R

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Attorney, Agent, or Firm—Burmeister, Palmatier & Hamby

[57] **ABSTRACT**

The illustrated switch comprises a push button which is movable in a casing and is enclosed by a boot made of flexible material. A latching mechanism is provided in the casing to retain the push button in a partially depressed position after alternate depressions of the push button. The mechanism causes the push button to return to its fully extended position after the intermediate depressions of the push button. The end of the boot is caused to follow the movement of the push button, preferably by means of a disk on the push button which is received in an annular groove within the boot, or by clamping a flange on the boot between two disks on the push button. Thus, the length of the boot indicates the position of the push button. A contactor is connected to the push button and is movable to different positions corresponding to the fully extended and partially depressed positions of the push button. A stem or pin is provided between the push button and the contactor. The stem also extends through a latch which is rotatable in successive steps by the operation of the push button. In alternate positions of the latch, it engages elements on the casing which retain the push button in its partially depressed position. Camming elements are provided on the push button, the latch and the casing to rotate the latch, with the assistance of a spring, mounted on the stem and acting between the contactor and the latch. The contactor may engage a set of contacts in the partially depressed position of the push button. In a modified construction, a second set of contacts is also provided for engagement by the contactor in the extended position of the push button. To provide a make-before-break action, the contactor may comprise two disks with a spring therebetween, slidably mounted on a sleeve which in turn is slidably mounted on the pin or shaft.

11 Claims, 30 Drawing Figures

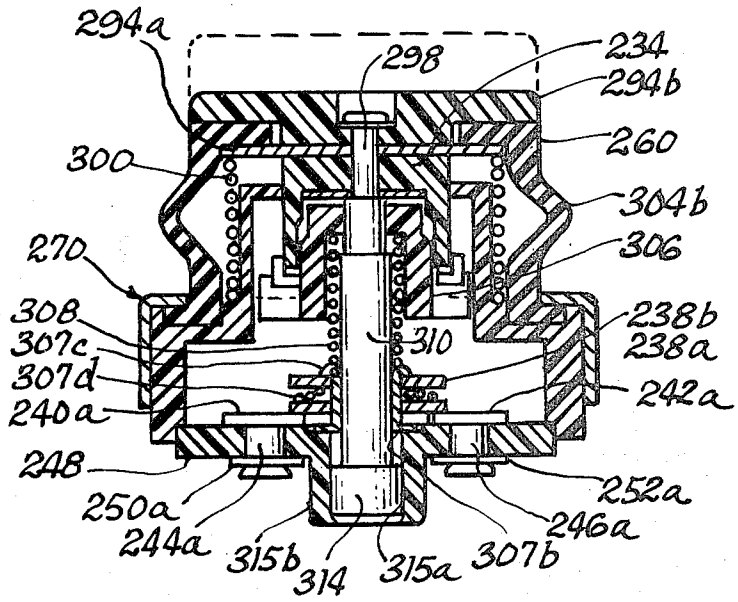


FIG. 1

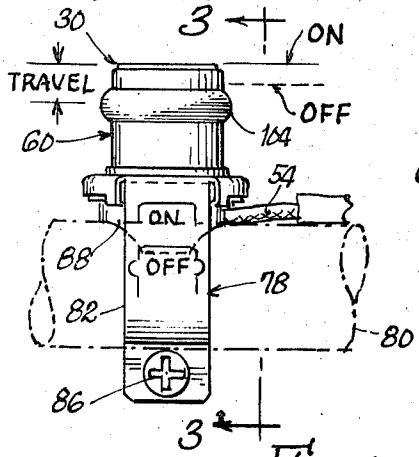


FIG. 2

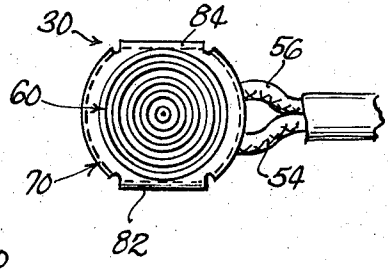


FIG. 3

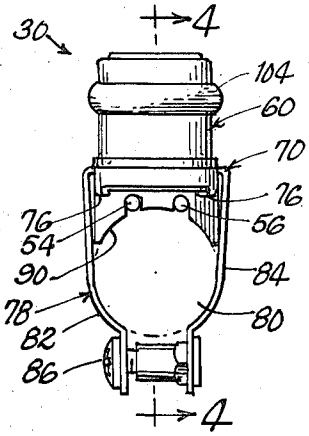


FIG. 4

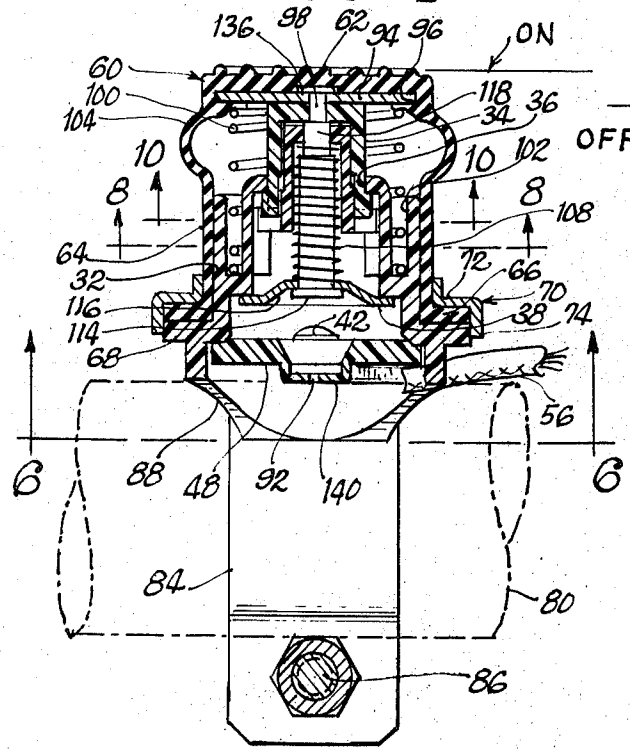


FIG. 5

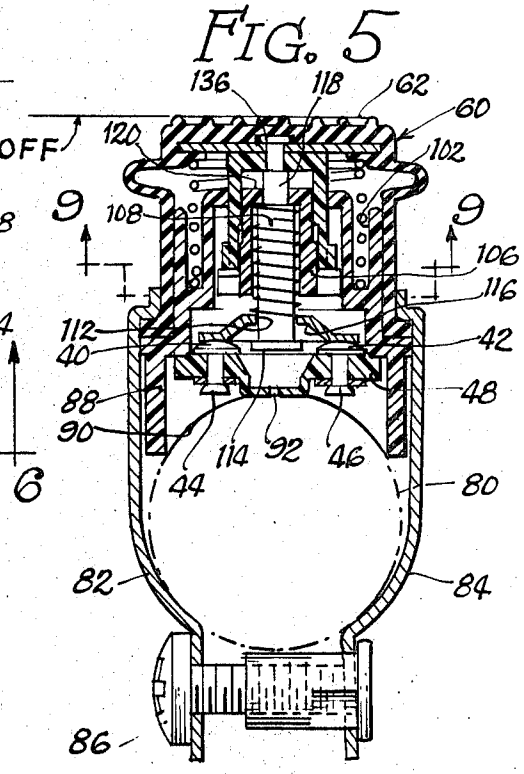
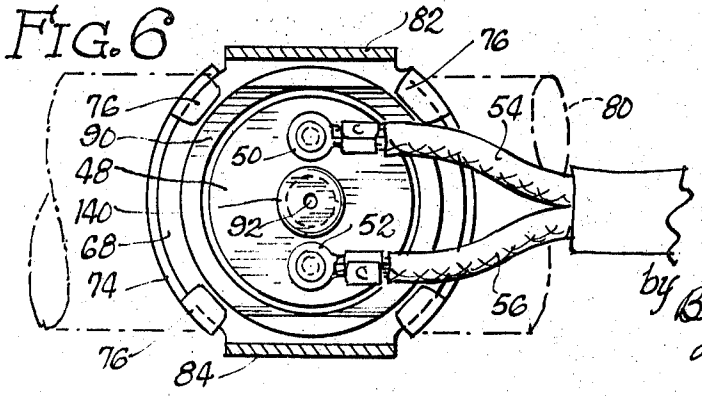


FIG. 6



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Andrew F. Raab
William J. Schaad
by Burmeister, Palmatier and Hamby Attys

FIG. 7

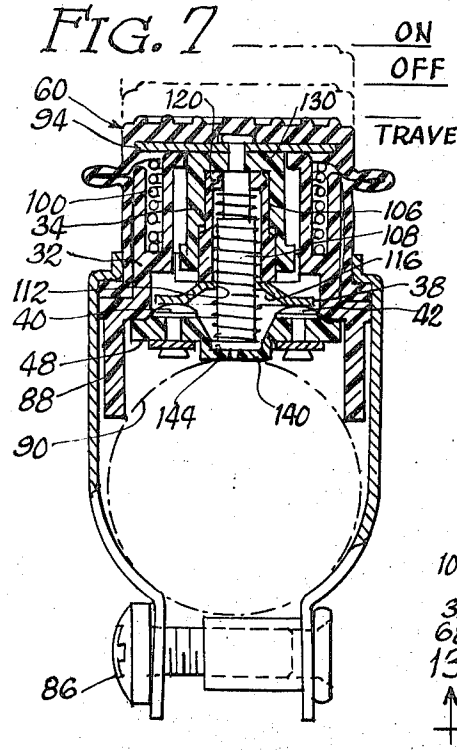


FIG. 8

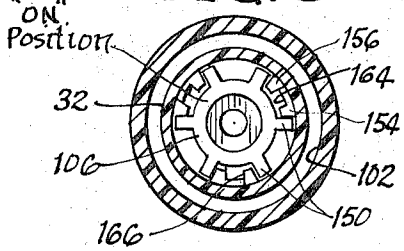


FIG. 9

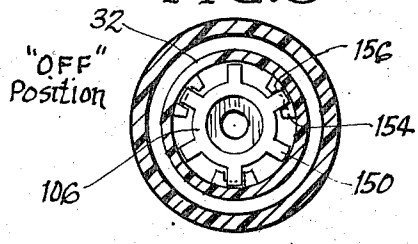


FIG. 10

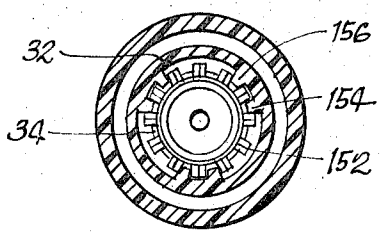


FIG. 11

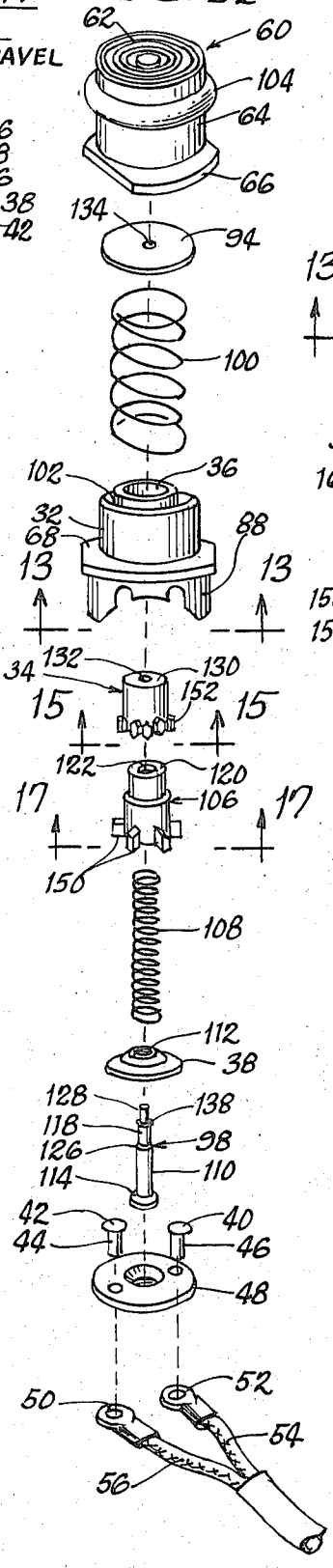


FIG. 12

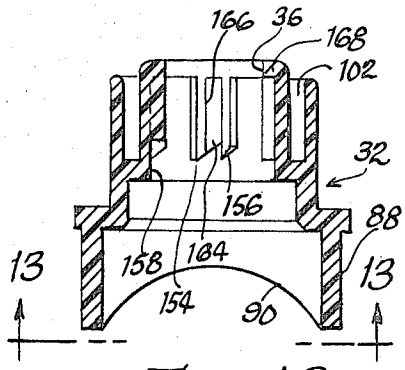


FIG. 13

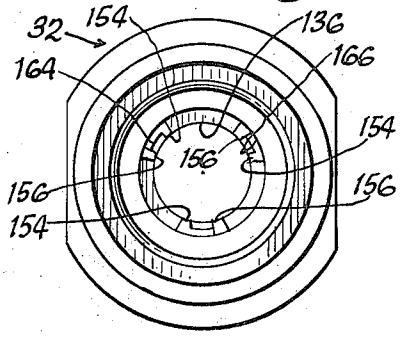


FIG. 14

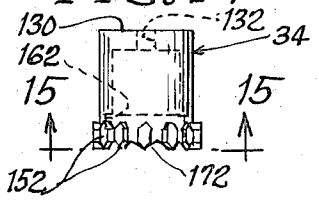


FIG. 15



FIG. 16

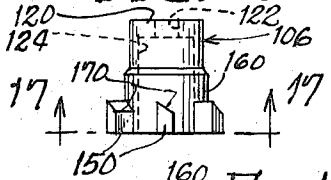


FIG. 17

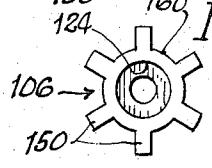


FIG. 18

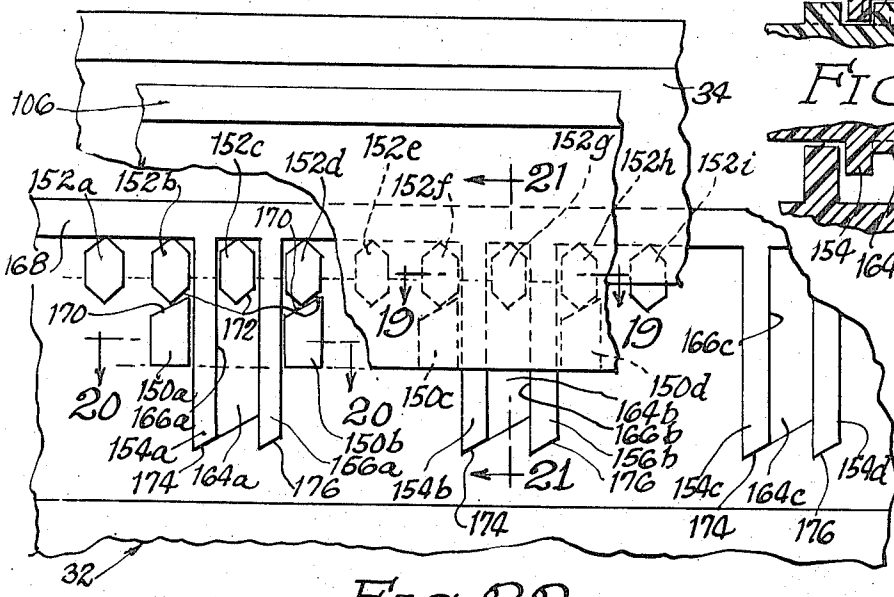


FIG. 19

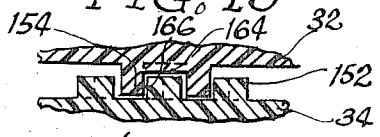


FIG. 20

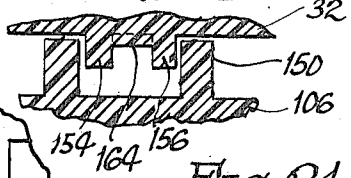


FIG. 21

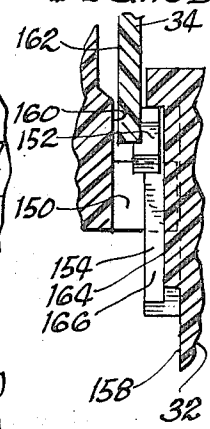


FIG. 22

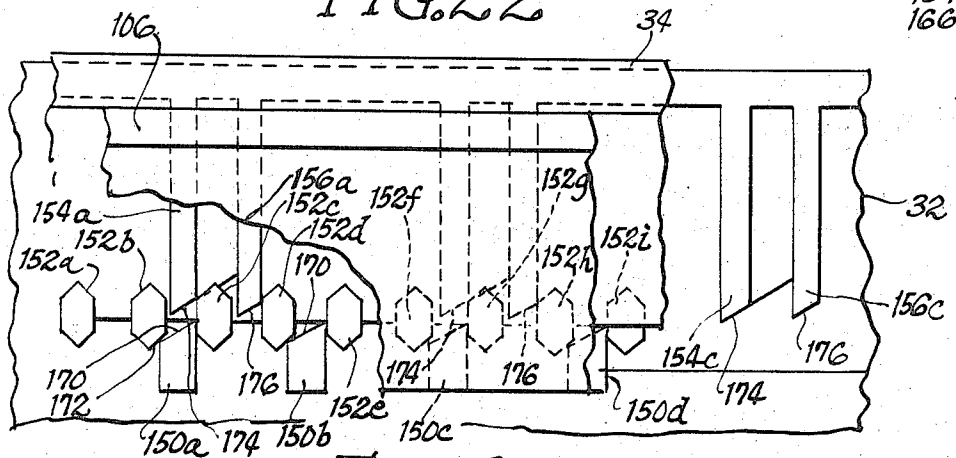


FIG. 23

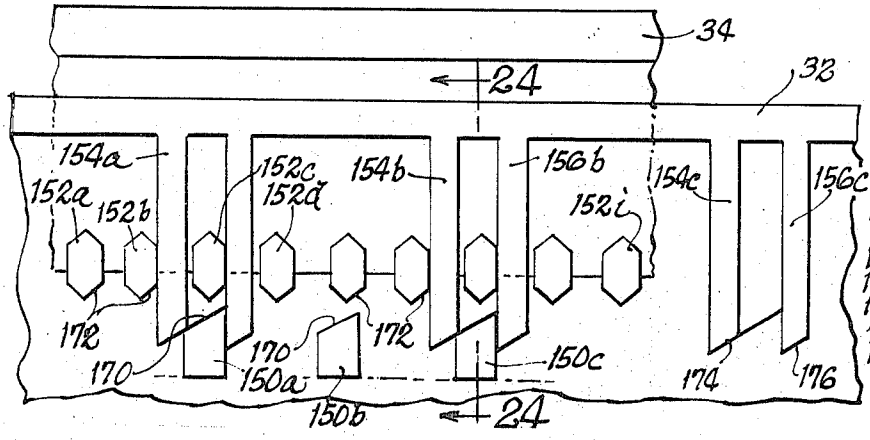


FIG. 24

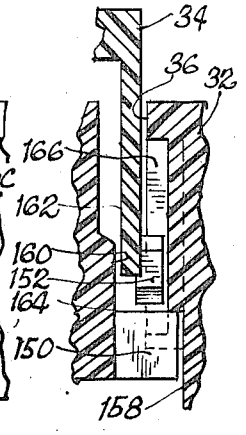


FIG. 25

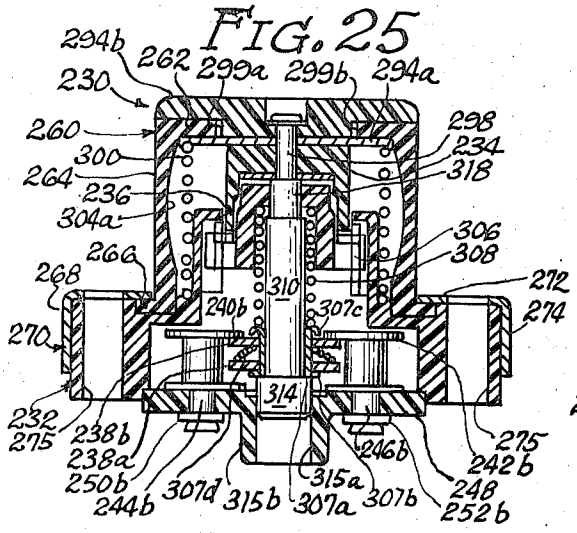


FIG. 26

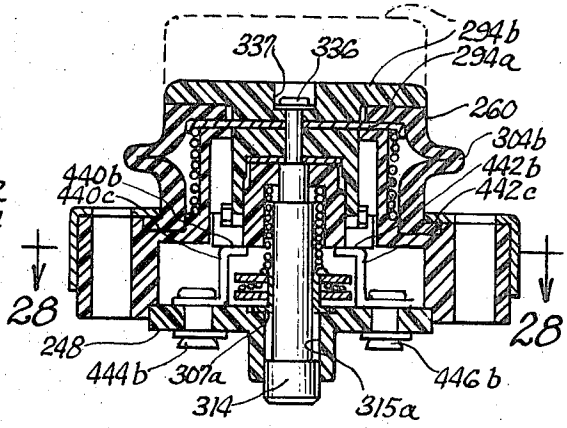


FIG. 27

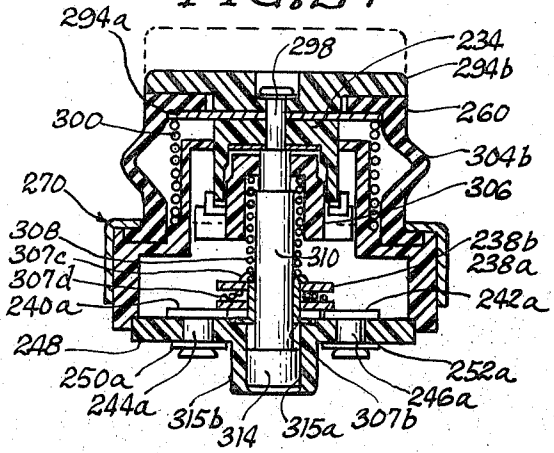


FIG. 28

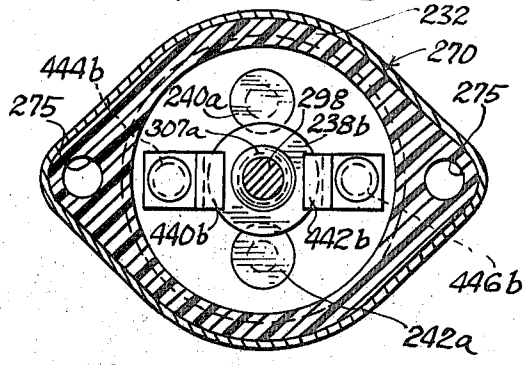


FIG. 29

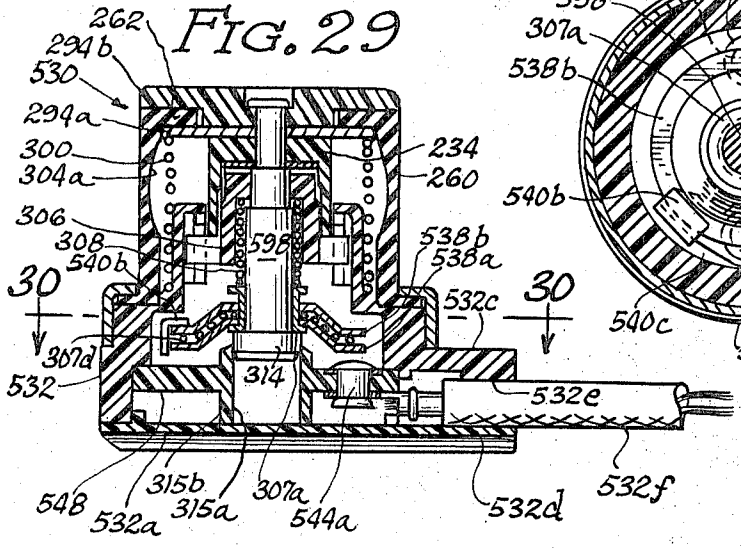
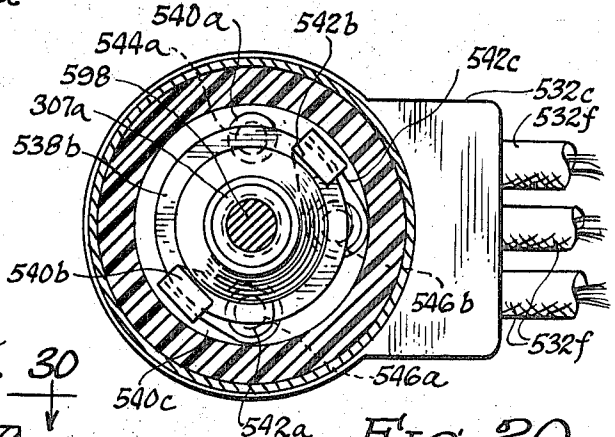


FIG. 30



ALTERNATE ACTION SWITCH WITH SEALING BOOTH GIVING VISUAL INDICATION OF SWITCH POSITION

This application is a continuation-in-part of our copending application Ser. No. 73,295, filed Sept. 18, 1970 now abandoned.

This invention relates to push action switches which are particularly well adapted for vehicular switching operations, but will find many other advantageous uses.

In one embodiment, the switch of the present invention is adapted to be actuated by depressing a push button to close the switch, and depressing the push button again to open the switch. In another embodiment, the switch closes on set of contacts in one position, and another set of contacts in the other position. The invention is also applicable to switches having more than two positions.

One object of the present invention is to provide a push action switch which is effectively sealed against the entry of moisture, dust and other foreign material which might impair the operation of the switch.

A further object is to provide a push action switch in which the external appearance of the switch is visibly different when the switch is in its different operating positions, so that the operator can readily observe whether the switch is "on" or "off."

Another object is to provide a push action switch which is easy to operate, yet extremely rugged, so that the switch will withstand long and hard service.

A further object is to provide a push action switch which has a positive snap action yet is small in size and inexpensive to manufacture.

Thus, the present invention preferably comprises a push action switch having a casing with an opening in which the push button or plunger is slidable. A mechanism is provided in the casing to latch or otherwise retain the push button in a partially depressed position, after alternate depressions of the push button. The intermediate depressions of the push button cause it to return outwardly to its fully extended position. A contractor within the casing is moved to two different positions corresponding to the extended and partially depressed positions of the push button. A boot made of rubber or other flexible material is mounted around the push button to exclude moisture, dust and other adverse atmospheric conditions. The boot is arranged to follow the movement of the push button so that it is readily possible to determine the position of the contactor by observing the position of the boot. In one embodiment, the push button is connected to the boot by means of a disk or other flange element on the push button. Such flange element is preferably received in a groove or recess within the boot. The boot may have an annular convolution which bulges outwardly when the push button is in its partially depressed position.

In another embodiment, the boot has an inwardly directed flange which is clamped between two disks or flanges on the push button.

The mechanism within the casing includes a latch which is rotated through successive steps by the successive depressions of the push button. Camming elements are provided on the latch, and also on the push button and the casing, to effect such step-wise rotation of the latch. In alternate positions, the latch is effective to retain the push button in its partially depressed position.

The push button preferably carries a stem or pin on which the contactor is mounted. The stem also preferably passes through an opening in the latch. To assist in the operation of the latch, a spring is preferably mounted around the stem between the latch and the contactor. The spring may also provide contact pressure between the contactor and stationary contacts which are mounted in the casing.

In one embodiment, the contactor engages one set of contacts in the depressed position of the push button. In another embodiment, there is also a second set of contacts, engageable by the contactor in the extended position of the push button. To provide a make-before-break action, the contactor may comprise two disks or other means with a spring therebetween. The disks may be slidably mounted on a carrier, which in turn is slidably mounted on the stem.

Further objects, advantages and features of the present invention will appear from the following description, taken with the accompanying drawings, in which:

FIG. 1 is an elevation of a push action switch to be described as an illustrative embodiment of the present invention.

FIG. 2 is a top view of the switch.

FIG. 3 is an elevational section taken generally along the line 3—3 in FIG. 1.

FIG. 4 is an enlarged elevational section, taken generally along the line 4—4 in FIG. 3, the switch being shown in its "on" position.

FIG. 5 is a view similar to FIG. 4, but showing the switch in its "off" position.

FIG. 6 is a bottom view, partly in section along the line 6—6 in FIG. 4.

FIG. 7 is a view similar to FIGS. 4 and 5, but showing the switch in its fully depressed position.

FIG. 8 is a transverse section, taken generally along the line 8—8 in FIG. 4, the switch being shown in its "on" position.

FIG. 9 is a transverse section taken generally along the line 9—9 in FIG. 5, the switch being shown in its "off" position.

FIG. 10 is a section taken generally along the line 10—10 in FIG. 4, with the latch removed to avoid obscuring details of the push button.

FIG. 11 is a disassembled or exploded perspective view of the switch.

FIG. 12 is a central longitudinal section taken through the casing of the switch.

FIG. 13 is a bottom view of the casing, taken as indicated by the lines 13—13 in FIGS. 11 and 12.

FIG. 14 is an elevation of the push button.

FIG. 15 is a bottom view of the push button taken generally as indicated by the lines 15—15 in FIG. 11 and 14.

FIG. 16 is an elevation of the latch.

FIG. 17 is a bottom view of the latch, taken generally as indicated by the lines 17—17 in FIG. 11 and 16.

FIG. 18 is a fragmentary disgrammatic developed elevation to show the action of the camming elements which cause rotation of the latch, the switch being shown in its "on" position.

FIG. 19 is a fragmentary section taken generally along the line 19—19 in FIG. 18.

FIG. 20 is a fragmentary section taken along the line 20—20 in FIG. 18.

FIG. 21 is a fragmentary section, taken generally along the line 21—21 in FIG. 18.

FIG. 22 is a view similar to FIG. 18, but showing the switch with the push button depressed.

FIG. 23 is another view similar to FIGS. 18 and 22, but showing the switch with the push button latched in the "off" position of the switch.

FIG. 24 is a fragmentary section taken generally along the line 24—24 in FIG. 23.

FIG. 25 is an enlarged longitudinal section showing a modified switch to be described as another illustrative embodiment of the present invention, the push button of the switch being shown in its fully extended position.

FIG. 26 is a view similar to FIG. 25, but showing a further modification, the push button being shown in its fully depressed position.

FIG. 27 is a view similar to FIG. 26, but with the longitudinal section taken at right angles to the section of FIG. 26, the switch being shown with the push button latched in its partially depressed position.

FIG. 28 is a cross-section taken generally along the lines 28—28 in FIG. 26

FIG. 29 is a longitudinal section showing another modified switch construction.

FIG. 30 is a cross-section taken along the line 30—30 in FIG. 29.

It will be seen that FIGS. 1–24 illustrate a push action electrical switch 30 adapted to be operated between "on" and "off" positions. While the illustrated switch will find many applications, it was developed particularly for use as an ignition kill switch for a snowmobile. In this particular application, the switch short circuits the ignition circuit when the switch is in the "off" position. This has the effect of stopping the engine of the vehicle. Thus, the switch is closed in its "off" position and open in its "on" position.

The illustrated switch 30 comprises a casing or body 32 which may be made of a tough resinous plastic material, or any other suitable material. A push button or plunger 34 is slidable in an opening 36, formed in the casing 32.

A contactor 38 is movably mounted within the casing 32 and is adapted to engage stationary contact means, illustrated as comprising a pair of contact points 40 and 42. In this case, the contact points are formed as the heads of rivets 44 and 46, extending through an insulating disk or other member 48, closing one side of the casing 32. The insulating disk 48 is preferably made of a suitable plastic material. It may be welded or otherwise secured to the plastic material of the casing 32.

As shown, terminals or lugs 50 and 52 are mounted on rivets 44 and 46. Insulated leads 54 and 56 are connected to the terminals 50 and 52.

The push button 34 is enclosed within a boot 60, made of a flexible material, such as natural or synthetic rubber. The illustrated boot 60 has an end wall 62 and a generally cylindrical side wall 64. The push button 34 is operated by pressing upon the end wall 62 of the boot 60. It will be understood that the boot 60 is effective to exclude moisture, dust and other adverse atmospheric conditions from the switch. The lower end of the boot 60 is clamped against the casing 32 so as to form a seal therewith. As shown, the lower end of the boot 60 is formed with an outwardly projecting flange 66 which is clamped against an outwardly projecting flange 68 on the casing 32. The clamping action is achieved by suitable means, illustrated as a ring 70, made of metal or other suitable material. The ring 70 has a radial flange 72 which engages the flange 66, and a generally cylindrical flange 74 which extends around the flanges 66 and 68. As shown to best advantage in FIG. 6, ears or tabs 76 are bent from the flange 74, under the flange 68 on the casing 32.

In this case, the ring 70 is formed in one piece with a mounting bracket or clamp 78, adapted to be used to secure the switch 30 to a handle bar 80 or the like. For use on a snowmobile, it is advantageous to mount the switch 30 on the handle bar 80 of the vehicle, so that the switch will be readily accessible for quick operation. In the operation of a snowmobile, it sometimes happens that the throttle of the engine will freeze or stick in its open position. If this happens when the engine is started, the vehicle may run away due to the excessive speed of the engine, which actuates the automatic clutch often found on such vehicles. If the operator has dismounted from the vehicle to start the engine, the vehicle may run away from him unless some control device is provided for quickly stopping the engine. The illustrated switch may be employed very advantageously as such a control device.

The illustrated clamp 78 is in the form of a split band having legs 82 and 84, together with a screw 86 for tightening the clamp. To engage the handle bar 82, the casing 32 is formed with a skirt portion 88 having a cylindrically curved seat 90. The skirt 88, together with the handle bar 80, forms an enclosure for the rivets 44, the insulating terminal member 48, and the terminals 50 and 52, so that these components are protected from the weather. A small vent hole 92 is preferably formed in the insulating member 48 to prevent any build up of pressure within the casing 32. The vent hole 92 is in a protected position and is normally concealed by the skirt 88 and the handle bar 80.

In the illustrated switch 30, the push button 34 is fully extended when the switch is "on," as illustrated in FIG. 4. The push button 34 is latched in a partially depressed position when the switch is "off," as shown in FIG. 5. The boot 60 is constructed and arranged so that it follows and indicates the position of the push button 34. Thus, the "on" and "off" positions of the boot 60 are indicated in FIGS. 1, 4, 5, and 7. FIGS. 1 and 7 also indicate the maximum depression or travel of the boot 60. The switch is shown in its fully depressed position in FIG. 7.

As illustrated, the boot 60 is connected to the push button 34, so as to follow the movement thereof, by means of a flange element 94 mounted on the push button 34. An annular groove or recess 96 is formed within the boot 60 to receive the flange element 94. As shown, the flange element 94 takes the form of a disk, made of metal or some other suitable material. An axial pin or rivet 98 is preferably employed to secure the disk 94 to the push button 34.

It will be understood that the flange element 94 and the groove 96 provide interlocking elements on the push button 34 and the boot 60. The groove 96 is immediately adjacent the end wall 62 of the boot so that the flange element 94 engages the end wall.

The flange element 94 also engages one end of a return spring 100 which may assume various forms but is illustrated as a compression coil spring, acting between the flange element 94 and the casing 32. An annular groove or seat 102 is preferably formed in the casing 32 to receive the lower end of the return spring 100.

The return spring 100 is concealed within the flexible boot 60. It will be seen from FIGS. 4 and 5 that the cy-

lindrical side wall 64 of the boot 60 is formed with an outwardly bulging convolution or pleat 104 which is annular in shape. The convolution 104 bulges outwardly to a greater extent when the end of the boot 60 is pushed inwardly to depress the push button 34. Thus, the convolution 104 bulges outwardly to a greater extent when the push button 34 is in its partially depressed or "off" position, as shown in FIG. 5, than when the push button 34 is in its fully extended or "on" position, as shown in FIG. 4. Thus, the bulging of the conventional 104 provides an additional visual indication as to the position of the push button.

A latch 106 is mounted within the casing 32 to hold the push button 34 in its "off" position, as shown in FIG. 5. The construction of the latch 106 is shown to good advantage in FIG. 11. In this case, the latch 106 is generally cylindrical in shape and is rotatable and slidable within the push button 34.

In the illustrated construction, the pin or rivet 98 is employed to maintain the push button 34 and the latch 106 in their assembled relation. The contactor 38 is also mounted on the pin 98. A compression coil spring 108 is mounted around the pin 98 between the contactor 38 and the latch 106.

It will be seen from FIG. 11 that the pin 98 has an enlarged cylindrical portion 110 which extends through a central opening 112 in the contactor 38. Thus, the contactor 38 is rotatable and slidable on the enlarged portion 110. A head 114 is formed on the lower end of the pin 98 to act as a stop for limiting the downward movement of the contactor 38. While the illustrated contactor 38 is generally in the form of a flat disk, made of copper or some other conductive material, the central portion of the contactor is dished or formed upwardly to provide a downwardly facing recess 116 for the head 114. The spring 108 presses the contactor 38 downwardly so that it engages the head 114 when the switch is in its "on" position, as shown in FIG. 4.

The illustrated pin 98 has a reduced intermediate portion 118 for receiving and guiding the latch 106, which has an end wall 120 with an opening 122 therein, adapted to be slidably and rotatably mounted around the reduced portion 118. Below the end wall 120, the latch 106 has an enlarged opening 124 which affords clearance for the spring 108 and the enlarged portion 110 of the pin 98. A shoulder 126 is formed on the pin 98 between intermediate portion 118 and the enlarged portion 110, to limit the downward movement of the latch 106 relative to the push button 34.

It will be seen that the pin 98 has a reduced end portion 128 adapted to receive the push button 34 which has an end wall 130 with an opening 132 therein, adapted to fit around the reduced end portion 128. The flange element or disk 94 has a central opening 134 which is also adapted to receive the reduced end portion 128 of the pin 98. As shown in FIGS. 4 and 5, the disk 94 is retained against the end of the push button 34 by upsetting the reduced end portion 128, as indicated at 136. The disk 94 and the end wall 130 of the push button 34 are clamped or retained between the upset portion 136 and a shoulder 138, formed on the pin 98 between the intermediate portion 118 and the reduced end portion 128.

When the push button 34 is depressed, the contactor 38 is moved downwardly, because of its mounting on the pin 98. The contactor 38 engages the contact points 40 and 42, as shown in FIG. 5. Further downward movement of the push button 34 causes the enlarged portion 110 of the pin 98 to move downwardly through the opening 112 in the contactor 38. The spring 108 pushes the contactor 38 downwardly, and thus provides contact pressure between the contactor 38 and the contact points 40 and 42. The opening 112 in the contactor 38 is somewhat larger in diameter than the enlarged portion 110 of the pin 98, so that the contactor 38 is able to rock slightly relative to the pin, so that the contact pressure between the contactor 38 and the two contact points 40 and 42 will be equalized.

The push button 34 can be depressed an appreciable distance beyond the "off" position, shown in FIG. 5. The fully depressed position of the push button 34 is shown in FIG. 7, in which the disk 94 engages the upper end of the casing 32, to limit the downward movement of the push button. In this position, the head 114 of the pin 98 projects downwardly into a downwardly offset central portion 140 of the insulating disk or wall 48, on which the contact points 40 and 42 are mounted.

Camming means are preferably provided on the casing 32, the push button 34, and the latch 106 to actuate the latch, so that the push button will be retained in its partially depressed or "on" position, when the push button is depressed once, while being released to its fully extended or "off" position, when the push button is depressed a second time. In the illustrated construction, such camming means comprise a plurality of teeth 150 on the latch 106, a plurality of teeth 152 on the push button 34, and a plurality of pairs of splines or ribs 154 and 156, projecting inwardly from the casing 32, as illustrated to advantage in FIG. 11, and also in FIGS. 18–24. The teeth 150 project outwardly from the latch 106 and are slidably and rotatably received within a bore or opening 158 formed in the casing 32. The latch 106 has an enlarged cylindrical portion 160 which is rotatably and slidably received within an opening 162 in the push button 34.

In this case, there are six teeth 150 on the latch 106, 12 teeth 152 on the push button 34, and three pairs of the splines 154 and 156 projecting inwardly from the bore 158 in the casing 32. However, the number of teeth and splines can be varied.

A step 164 is disposed between each pair of splines 154 and 156. The step 164 projects inwardly from the bore 158, as will be evident from FIGS. 20 and 21. The step 164 forms the bottom of a groove 166 between the splines 154 and 156.

For clarity of explanation, the teeth 150 will be designated 150*a*, *b*, *c* and *d* in FIGS. 18, 22 and 23, which are developed or flattened views looking at the inside of the casing 32. Similarly, the teeth 152 on the push button 34 will be designated 152*a–i*. The splines 154 and 156 will be designated 154*a*, *b* and *c* and 156*a*, *b* and *c*. Likewise, the steps and grooves 164 and 166 will be designated 164*a*, *b* and *c* and 166*a*, *b* and *c*.

It will be seen from FIG. 18 that the teeth 152*c* are 152*g* are slidably received in the grooves 166*a* and *b*. In this way, rotation of the push button 34 is prevented, so that the push button is slidable but not rotatable within the casing 32. The teeth 152*c* and *g* are slidable along the steps 164*a* and *b*.

FIG. 18 represents the fully extended or "on" position of the push button 34. In this position, the teeth 152 engage the end wall 168 of the casing 32. It will be understood that the return spring 100 biases the push button 34 toward its fully extended position. In FIG.

18, the splines 154*a* and 156*a* are received between the teeth 150*a* and *b* on the latch 106. Similarly, the splines 154*b* and 156*b* are received between the teeth 150*c* and *d*. The teeth 150*a*, *b*, *c* and *d* on the latch engage the teeth 152*b*, *d*, *f* and *h* on the push button 34. The spring 108 biases the latch 106 outwardly so that its teeth 150 engage the aligned teeth 152 on the push button.

The latch teeth 150 have inclined camming surfaces 170 which are engageable with inclined camming surfaces 172 on the push button teeth 152. The camming surfaces 170 and 172 are inclined relative to the axis of the push button 34. Because of the force exerted by the spring 108, the camming surfaces 170 and 172 tend to cause rotation of the latch 106 to the right, as illustrated in FIG. 6. However, the splines 154 and 156 prevent such rotation by meshing with the teeth 150.

When the push button 34 is depressed, the push button teeth 152 move the latch teeth 150 downwardly, as shown in FIG. 22, until the latch teeth 150 escape from the splines 154, with the result that the teeth 150 slip or rotate to the right due to the camming action between the inclined surfaces 170 and 172. The latch 106 is thereby rotated through a small step until the latch tooth 150*a* engages the side of the next push button tooth 152*c*, as shown in FIG. 22. Similarly, the teeth 150*b*, c and *d* move against the push button teeth 152*e*, *g* and *i*. It will be seen that the latch teeth 150*a* and *c* are aligned with the splines 154*a* and *b*.

Thus, when the push button 34 is released, the latch teeth 150 follow the push button teeth 152 upwardly until the camming surfaces 170 on the latch teeth 150*a* and *c* engage inclined camming surfaces 174 on the splines 154*a* and *b*. These camming surfaces 174 also extend along the steps 164*a* and *b*. The camming surfaces 174 arrest the return movement of the latch teeth 150. Due to the force exerted by the return spring 100, the camming surfaces 170 and 174 cause additional rotation or slipping movement of the teeth 150 to the right, until the teeth 150*a* and *c* engage the sides of the splines 156*a* and *b*, as shown in FIG. 23. This represents the partially depressed or "off"]position of the switch. The engagement of the latch teeth 150 with the camming surfaces 174 prevents the return movement of the latch 106. Due to the very limited lost motion between the push button 34 and the latch 106, the return movement of the push button is also prevented. The lost motion between the latch 106 and the push button 34 is determined by the length of the intermediate portion 118 of the pin 98, the latch being slidable to a limited extent along the intermediate portion 118.

When the push button 34 is again depressed, the splines 156 prevet rotation of the latch 106 until the teeth 150 are moved downwardly to a sufficient extent to escape from the splines 156, whereupon the camming action between the surfaces 170 and 172 causes the latch teeth 150 to slip or rotate to the right. The camming surfaces 170 on the latch teeth 150*a* and *c* engage camming surfaces 176 on the splines 156*a* and *b*. The camming action between the surfaces 170 and 176 causes additional rotation or slipping movement of the latch teeth 150 to the right until the camming surfaces 170 escape from the camming surfaces 176, whereupon the latch teeth 150 are returned upwardly with the splines 154 and 156 therebetween, to a position corresponding to that shown in FIG. 18, but with the latch displaced or rotated through one full step to the right, so that the latch tooth 150*a* is moved to the position occupied by the tooth 150*b* in FIG. 18.

It may be helpful to summarize the operation briefly. In FIGS. 4 and 18, the push action switch is shown in its fully extended or "on" position. When the push button 34 is depressed by pushing on the end wall 62 of the flexible boot 60, the latch 106 travels downwardly without rotating, until the latch teeth 150*a* and *c* are below the ends of the splines 154*a* and *b*, whereupon the camming action between the inclined surfaces 170 and 172 on the latch teeth 150 and the push button teeth 152 causes the latch 106 to rotate through a partial step to the right, until the latch teeth 150 are arrested by the adjacent push button teeth 152 as shown in FIG. 23. When the push button 34 is released, the camming surfaces 170 on the latch teeth 150 engage the camming surfaces 174 on the casing 32. Such engagement causes the latch teeth 150 to slip to the right so that the latch 106 is rotated until the latch teeth engage the splines 156, as shown in FIG. 23. The return of the latch 106 is thus prevented. The push button 34 is also retained in a partially depressed position, due to the very limited lost motion between the push button and the latch. In this partially depressed position, the contactor 38 is pressed against the contacts 40 and 42 by the spring 108.

When the push button 34 is again depressed by pushing on the end wall 62 of the boot 60, the latch teeth 150 escape from the splines 156, whereupon the camming action between the inclined surfaces 170 and 172 causes additional rotation or slipping movement of the latch teeth 150 to the right until the camming surfaces 170 engage the inclined surfaces 176 on the splines 156. The resultant camming action rotates the latch 106 until the splines 154 and 156 enter the spaces between the latch teeth 150, whereupon the latch 106 and the push button 34 are returned to their fully extended positions, as shown in FIGS. 4 and 18.

It will be appreciated that the push action switch is extremely rugged and virtually indestructible. The switch can be operated very quickly by striking the end of the boot 60 with the operator's fist or hand. The operator can easily operate the switch even though he is wearing heavy mittens or gloves. Thus, the switch is very well suited for use as an emergency kill switch for stopping the engine on a snowmobile to prevent the machine from running away if the throttle freezes or sticks in the "open" position when the engine is started.

The position and appearance of the boot 60 indicate the position of the switch. When the boot 60 is extended, the switch is "on." When the convolution 104 on the boot 60 is prominent, as shown in FIG. 5, and the boot is shortened, the switch is in its "off" position.

In the illustrated switch, the contactor is mounted on the push button or plunger. However, it will be understood that the contactor can be mounted on the latch. While the illustrated contactor is of the linear, movable type, it can be of the rotary type, particularly when the contactor is mounted on the latch, which is caused to rotate, as an incident to its latching function.

While the illustrated switch produces a closed circuit in its depressed position, the switch can be arranged to produce a closed circuit in its extended position.

FIG. 25 illustrates a modified push action switch 230 which is similar in many respects to the switch 30 already described. Many of the components of the switch 230 are similar to those of the switch 30. To avoid repe-

titious description, corresponding components of the switch 230 will be given reference characters which are increased by 200, with respect to the corresponding components of the switch 30. In this way, the previous description of the switch 30 can readily be applied to the switch 230. The corresponding components of the switches 230 and 30 may be the same in construction, except as otherwise specified in the following description, which can thus be confined for the most part to the differences between the switch 230 and the previously described switch 30 of FIGS. 1–24.

Instead of having an "off" position and an "on" position, the switch 230 has two "on" positions, in which two different circuits are closed. The switch 230 will find many applications. For example, the switch may be employed to close the circuits to the low and high beam lamps or filaments of an automotive head lamp arrangement. Many other applications of the switch will be evident to those skilled in the art.

The switch 230 of FIG. 25 comprises a modified casing or body 232, as before. A push button or plunger 234 is slidable in an opening 236, formed in the casing 232.

While the switch 230 might have a single contactor, as before, it is preferred to provide two contactors 238*a* and *b*. In the latched or paritally depressed position of the push button 234, as shown in FIG. 27, the first contactor 238*a* engages contact points 240*a* and 242*a*. In the fully extended position of the push button 234, the second contactor 238*b* is moved into engagement with fixed contacts 240*b* and 242*b*. The contact points 240*a* and 242*a* are formed as the heads of rivets 244*a* and 246*a*, extending through an insulating member 248, welded or otherwise secured to the casing 232.

The other fixed contacts 240*b* and 242*b* may be formed in various ways. As shown in FIG. 25, the fixed contacts 240*b* and 242*b* are in the form of flanges or heads on shouldered rivets 244*b* and 246*b*. It will be seen that the flange contacts 240*b* and 242*b* are spaced a substantial distance above the insulating member 248. When the push button 234 is fully extended, as shown in FIG. 25, the second contactor 238*b* engages the undersides of the flanges 240*b* and 242*b*.

As shown in FIG. 27, terminals 250*a* and 252*a* are mounted on the rivets 244*a* and 246*a*. It will be seen from FIG. 25 that terminals 250*b* and 252*b* are mounted on the rivets 244*b* and 246*b*. If desired, one of the terminals, such as the terminal 250*b*, may be in the form of a strap connected to another rivet, such as the rivet 244*a*. In this way, two of the rivets will be connected in common, as to a battery circuit, for example. Further details of the contactors and contacts will be described presently.

The push button 234 is enclosed within a flexible boot 260. Instead of having a solid end wall, the boot 260 has an annular flange 262, projecting inwardly from a cylindrical sidewall 264. The lower end of the boot 260 is formed with an outwardly projecting flange 266 which is clamped against an outwardly projecting flange 268 on the casing 232. The clamping action is achieved by a clamping member 270, preferably made of metal, and formed with a radial flange 272 and a skirt 274. The clamping member 270 may be secured to the casing 232 by means of ears or tabs, as previously described.

The illustrated flange 268 on the casing 232 is formed with mounting holes 275. Corresponding holes are formed in the clamping member 270.

As before, the boot 260 follows the movement of the push button 234 and indicates the position of the push button, whether it is in its extended position of FIG. 25, or its latched, partially depressed position of FIG. 27. Thus, the boot 260 is connected to the push button 234 so as to follow the movement thereof. This may be achieved by means of flange elements 294*a* and *b*, mounted on the push button 234. In the construction of FIG. 25, the inwardly directed flange 262 on the boot 260 is clamped or retained between the flange elements 294*a* and *b*. As before, the flange element 294*a* preferably takes the form of a metal disk, mounted on an axial pin or rivet 298, extending through corresponding openings in the push button 234 and the disk 294*a*. The other flange element 294*b* may also be in the general form of a disk, appertured to receive the pin 298. The disk 294*b* may be made of a resinous plastic or some other suitable material.

As shown, the flange element or disk 294*b* has a recduced lower portion 299*a* which extends through the internal opening 299*b* formed by the flange 262 on the boot 260. The reduced portion 299*a* engages the disk 294*a*.

As before, a return spring 300 is compressed between the flange element 294*a* and the body or casing 232. The spring 300 is disposed within the flexible boot 260.

Instead of having a pronounced initial pleat or convolution, as previously described, the sidewall 254 of the boot 260 is closely cylindrical on its outer side when the boot 260 is fully extended, as shown in FIG. 25. However, the sidewall 264 has an inner surface 304*a* which is barrel shaped, so that the thickness of the sidewall 264 is reduced around the central portion thereof. Thus, when the push button 234 and the boot 260 are depressed, as shown in FIGS. 26 and 27, the central portion of the sidewall 264 bulges outwardly to form a pronounced annular convolution 304*b*. In this way, the appearance of the convolution 304*b* makes it clearly evident that the push button is depressed. As before, a latch 306 is mounted within the casing 232 to hold the push button 234 in its partially depressed position, as shown in FIG. 27. The latch 306 is the some in construction and operation as previously described with reference to the latch 106. The cooperative elements on the push button 234 and the casing 232 are also the same as described with reference to the corresponding elements of FIGS. 1–24.

As before, the latch 306 is rotatably and slidably mounted on the pin or rivet 298, which also carries the contactors 238*a* and *b*. However, in this case, it is preferred to mount the contactors 238*a* and *b* on a sleeve 307*a*, which is slidably mounted on the enlarged portion 310 of the pin 298. The illustrated sleeve 307*a* is in the form of an eyelet having heads or flanges 307*b* and 307*c* at both ends. The contactors 238*a* and *b* are preferably in the form of appertured disks which are slidably mounted on the sleeve 307*a*. A spring 307*d* is preferably compressed between the contactors 238*a* and *b*, so that the contactors are biased towards the flanges 307*b* and *c*. A compression coil spring 308 is preferably mounted around the pin 298 between the sleeve 307*a* and the latch 306.

As shown in FIG. 25, the lower end of the pin 298 is preferably formed with a cylindrical head 314 which

retains the sleeve **307***a* and also is slidably piloted in an opening **315***a*, formed in a projecting portion **315***b* of the insulating member **248.** In this way, the pin **298** is guided for axial sliding movement. This guiding action maintains the contactors **238***a* and *b* in its desired relationship to the fixed contacts **240***a*, **242***a*, **240***b* and **242***b*.

The latch **306** is guided on the pin **298** in the same manner as described with reference to the pin **98.** As before, the pin **298** has an upset end portion or head **336,** which, in this case, is recessed into a counter-bore **337** formed in the disk **294***b*. If desired, the counterbore **337** may be filled with an insulating material so that the head **336** will not be exposed.

As before, camming means are preferably provided on the casing **232,** the push button **234** and the latch **306** to actuate the latch so that the push button will be retained in its partially depressed position, when the push button is depressed once, and will be released to its fully extended position, when the push button is depressed a second time. Such camming means may be the same as described in connection with the switch **30** of FIGS. **1–24.**

In FIG. **25,** the push button **234** and the flexible boot **160** are fully extended. In this position, the counter disk **238***b* engages the fixed contact flanges **240***b* and **242***b* on the shouldered rivets **240***b* and **246***b*. Thus, the circuit between these rivets is completed. This circuit may be employed to energize the high beam filament or filaments in an automotive head lamp circuit. The switch is particularly advantageous for use in the head lamp circuit of a snowmobile or the like, because the switch may readily be mounted on the handle bar of such a vehicle. The operator of the vehicle can easily operate the switch with one thumb or finger while he retains his grip on the handle bar.

When the contactor **238***b* engages the contact flanges **240***b* and **242***b*, the contactor is moved away from the flange **307***c* on the sleeve **307***a*, so that the spring **307***d* presses the contactor against the contact flanges. This arrangement assures firm and uniform contact pressure between the contactor **238***b* and the contact flanges **240***b* and **242***b*. The spring **307***d* is preferably of the conical compression type so that it can be compressed fully between the contactors **238***a* and **238***b*, as needed. The axial opening in the contactor **238***b* affords sufficient clearance around eyelet sleeve **307***a* to provide for a considerable degree of rocking movement of the contactor. In this way, the contactor **238***b* can be rocked by the spring **307***d* so as to equalize the contact pressure between the contactor **238***b* and the contact flanges **240***b* and **242***b*. In the extended position of FIG. **25,** the spring **308** presses the eyelet sleeve **307***a* against the enlarged head **314.**

The provision of the dual slidable contactors **238***a* and *b*, with the spring **307***d* therebetween, results in a make-before-break action when the push button **234** and the boot **260** are depressed. Such depression causes the pin **298** to be moved downwardly. The enlarged head **314** on the pin is slidably guided in the opening **315***a*. The spring **308** causes the eyelet sleeve **307***a* to be moved downwardly with the pin **298.** However, the upper contactor **238***b* continues to be held against the fixed contact flanges **240***b* and **242***b*. The lower contactor **238***a* moves downwardly along with the sleeve **307***a*, until the lower contactor engages the fixed contacts **240***a* and **242***a*, somewhat as shown in FIG. **27.** The lower contactor **238***a* makes contact with the fixed contacts **240***a* and **242***a* before the upper contactor **238***b* breaks contact with the fixed contact flanges **240***b* and **242***b*. This make-before-break action is highly advantageous in that it provides momentary overlapping in the energization of the two circuits controlled by the switch. When the switch is used in a head lamp circuit to energize the high and low beam filaments, there is a momentary interval of overlapping in which both the high and low beam filaments are energized. This mode of operation insures that there will be no momentary black-out of the lights when the switch is operated. Moreover, the head lamp load is kept on the energizing circuit at all times. This factor is particularly advantageous when the switch is used on a snowmobile or other vehicle in which the head lamp and tail lamp are energized directly from an alternator without any battery to stabilize the voltage. The overlapping in the energization of the high and low beam filaments insures that there will be no interval in which the head lamp load is not imposed upon the alternator. If there were any such interval of no head lamp load, the voltage would tend to rise to such an extent that the tail lamp might be burned out. The make-before-break action avoids any such problem.

FIG. **26** shows the fully depressed position of the push button **234** and the boot **260.** It will be seen that the pin **298** slides downwardly through the eyelet sleeve **307***a*, while the spring **308** is compressed. The spring **307***d* is also compressed between the contactors **238***a* and *b*. Thus, the engagement between the contactors and the fixed contacts does not interfere with the depression of the push button **234** and the boot **260**

FIG. **27** shows the latched position of the push button **234** in which it is held in a partically depressed position, in the manner described with reference to the switch **30.** It will be seen that the lower contactor **238***a* engages the fixed contacts **240***a* and **242***a*, while the upper contactor **238***b* engages the upper flange **307***c* on the eyelet sleeve **307***a*. *The spring 307d* is compressed between the contactors **238***a* and *b* and is effective to press the lower contactor **238***a* against the contact points **240***a* and **242***a*. The axial opening in the contactor **238***a* provides clearance around the eyelet sleeve **307***a* so that the contactor can be rocked sufficiently by the spring **307***d* to equalize the contact pressure between the contactor and the fixed contacts **240***a* and **242***a*. The lower contactor **238***a* is displaced upwardly from the lower flange **307***b* on the eyelet sleeve **307***a*.

When the push button **234** is again depressed, the latch **306** is released, so that the push button is allowed to return to its fully extended position when the operating pressure on the push button is removed. As the push button **234** travels upwardly, the enlarged head **314** on the pin **298** picks up the eyelet sleeve **307***a* and causes it to move upwardly. The upper contactor **238***b* is moved upwardly with the eyelet sleeve **307***a* until the upper contactor makes contact with the fixed contact flanges **240***b* and **242***b*, somewhat as shown in FIG. **25.** Shortly thereafter, the lower flange **307***b* on the eyelet sleeve **307***a* picks up the lower contactor **238***b* and moves it upwardly, out of contact with the fixed contacts **240***a* and **242***a*. Thus, there is also a make-before-break action during the return movement of the push button **234** and the boot **260.**

When the push button **234** is fully extended, as shown in FIG. **25,** the sidewall **264** of the boot **260** is

substantially cylindrical. When the push button 234 is latched in its partially depressed position, as shown in FIG. 27, the convolution 304*b* is quite pronounced in the sidewall 264 of the boot 260. This action gives a definite indication that the push button switch is in its depressed position.

The flange member or disk 294*b* on the upper end of the push button 234 may be marked with words or symbols to identify the switch and to indicate its function. Thus, for example, the word DIM may be applied to the disk 294*b* when the switch is to be used to control the high and low beam filaments of the head lamps. The disk 294*b* may be of various colors to identify the switch.

In nearly all respects FIGS. 26, 27 and 28 correspond with FIG. 25, but FIGS. 26 and 28 show a modified contact construction in which the fixed contact flanges 240*b* and 242*b* of FIG. 25 are replaced by contact flanges 440*b* and 442*b*, preferably formed on Z-shaped contact members 440*c* and 442*c*, which may be made of sheet metal. The Z-shaped contact members 440*c* and 442*c* are secured to the insulating member 248 by rivets 444*b* and 446*b*. The Z-shaped contact members 440*c* and 442*c* replace the shouldered rivets 244*b* and 246*b* of FIG. 25. It will be seen that the rivets 444*b* and 446*b* of FIG. 26 are completely away from the lower contactor 238*a*.

FIG. 28 illustrates the modified contact construction of FIG. 26. FIG. 27 corresponds to both FIGS. 25 and 26, inasmuch as the section plane of FIG. 27 is taken through the fixed contacts 240*a* and 242*a*, which are the same in both the switch 230 of FIG. 25 and the modified version of FIG. 26.

FIGS. 29 and 30 illustrate another modified switch 530 which is the same in most respects as the switch 230 of FIG. 25. However, the switch 530 has a casing 532 of modified shape. A cover member 532*a* is provided to close the lower end of the casing, so that all of the contact rivets and terminals are fully enclosed and insulated. In this way, any possibility of a short-circuit is obviated. The cover 532*a* may be suitably secured to the casing 532 by ultrasonic welding or otherwise.

The casing 532 and the cover 532*a* have radially projecting stub members 532*c* and 532*d* with openings 532*e* therein through which connecting leads 532*f* are brought out. The leads 532*f* may be tightly sealed in the openings 532*e* to exclude moisture.

In the modified switch 530 of FIG. 29, the flat contactor disks 238*a* and *b* of FIG. 25 are replaced by dished contactor disks 538*a* and *b*. The dish-shape of the contactors 538*a* and *b* makes it possible to provide a more compact switch construction utilizing a shorter inner pin 598 in place of the pin 298. As before, the conical spring 307*d* is compressed between the contactors 538*a* and *b*. The eyelet sleeve 307*a* and the spring 308 are substantially the same as before.

The switch 530 utilizes fixed contacts 540*a* and 542*a*, which take the form of rounded heads on rivets 544*a* and 546*a*. The contacts 540*a* and 542*a* are engaged by the lower contactor 538*a* when the push button 234 is depressed. When the push button 234 is extended, the upper contactor 538*b* engages fixed contacts 540*b* and 542*b*, which are preferably in the form of flanges formed on sheet metal contact members 540*c* and 542*c*. It will be seen that the contact members 540*c* and 542*c* are different in shape from the sheet metal contact members 440*c* and 442*c* of FIG. 26. In this case, the contact member 540*c* is secured to the insulating member 548 by the rivet 546*a*, on which the contact point 542*a* is formed. Thus, the rivet 546*a* serves as a common terminal for the contact point 542*a* and the contact member 540*c*, on which the contact flange 540*b* is formed. A separate rivet 546*b* may be employed to secure the other contact member 542*c* to the insulating member 548.

When the push button 234 is extended, as shown in FIG. 29, the upper contact disk 538*b* engages the overhanging contact flanges 540*b* and 542*b*. The spring 307*d* is compressed, as before, between the contactors 538*a* and *b*, to provide contact pressure between the contactor 538*b* and the contact flanges 540*b* and 542*b*. The action of the contactors 538*a* and *b* is the same as described with reference to the contactors 238*a* and *b* of FIG. 25.

When the push button 234 of FIG. 29 is depressed, the lower contactor 538*a* engages the fixed contact points 540*a* and 542*a*. Such engagement occurs before the contact is broken between the contactor 538*b* and the contact flanges 540*b* and 542*b*. This make-before-break action is essentially the same as described with reference to the contactors 238*a* and *b* of FIG. 25. The make-before-break action also occurs when the push button 234 is released to its extended position after being depressed a second time, in the same manner as previously described.

The rivet 546*b* has a head with a low profile so that the rivet is not engaged by the lower contactor 538*a* when it engages the fixed contacts 540*a* and 542*a*. Thus, the contactor 538*a* does not engage the rivet 546*b* at any time. It will be understood that the connecting leads 532*f* are connected to terminals on the rivets 544*a*, 546*a* and 546*b*.

In the switch 230 of FIG. 25, the lower contactor 238*a* does not engage the rivets 244*b* and 246*b* at any time. The lower contactor 238*a* is arrested in its downward movement by the contact points 240*a* and 242*a* and thus is prevented from engaging the rivets 244*b* and 246*b*.

In the switch 530 of FIG. 29, the contactors 538*a* and *b* can move apart to a spacing determined by the distance between the flanges or retainers 307*b* and *c* on the sleeve or carrier 307*a*. This distance determines the distance between the contactor surfaces which are presented to the contact elements. In order to produce the make-before-break action, such maximum distance between the contactor surfaces of the contactors 538*a* and *b* should be greater than the distance in an axial direction between the two sets of contact elements, one set comprising the fixed contacts 540*a* and 542*a*, while the other set comprises the flanges 540*b* and 542*b*.

We claim:

1. A push action electrical switch,
comprising a casing having an opening therein,
a push button slidably mounted in said opening,
a contactor movable within said casing and operable by said push button,
resilient means for biasing said push button outwardly,
a mechanism operable by depression of said push button for retaining said push button in a partially depressed position after alternate depressions of said push button,

said mechanism being operative to return said push button to its fully extended position after the intermediate depressions of said push button,
said contactor being movable to one position when said push button is fully extended while being operable to a second position when said push button is partially depressed,
a flexible boot mounted on said casing and disposed around said push button to protect said push button from atmospheric conditions,
said push button being operable by depressing said boot,
and means for causing said boot to follow the movement of said push button,
said boot thereby having an extended position when said push button is fully extended and a partially depressed position when said push button is retained in its partially depressed position,
whereby the position of said boot gives a visual indication of the position of said push button and the position of said contactor,
said boot comprising a generally cylindrical side wall and an end wall connected thereto for following and indicating the position of said push button,
said push button having an outwardly projecting flange element thereon,
said boot having an internal annular groove therein for receiving said flange element to cause said end wall of said boot to follow and indicate the position of said push button,
said side wall having an outwardly projecting annular convolution thereon which is operative to bulge outwardly when said push button is depressed,
said convolution thereby giving a further visual indication of the position of said push button.

2. A push action electrical switch,
comprising a casing having an opening therein,
a push button slidably mounted in said opening,
a contactor movable within said casing and operable by said push button,
resilient means for biasing said push button outwardly,
a mechanism operable by depression of said push button for retaining said push button in a partially depressed position after alternate depressions of said push button,
said mechanism being operative to return said push button to its fully extended position after the intermediate depressions of said push button,
said contactor being operable to one position when said push button is fully extended while being operable to a second position when said push button is partially depressed,
a flexible boot mounted on said casing and disposed around said push button to protect said push button from atmospheric conditions,
and means for causing said boot to follow the movement of said push button,
said boot thereby having an extended position when said push button is fully extended and a partially depressed position when said push button is retained in its partially depressed position,
said boot having an annular side wall with an annular portion of reduced thickness,
said annular portion bulging outwardly to form a pronounced convolution when said boot is in its partially depressed position,
whereby said boot gives a visual indication of the position of said push button and the position of said contactor.

3. A switch according to claim **2**,
in which said annular sidewall of said boot has an outer surface which is substantially cylindrical when the boot is extended,
said sidewall having an inner surface which is shaped to provide said annular portion of reduced thickness.

4. A switch according to claim **2**,
in which said annular sidewall of said boot has an outer surface which is substantially cylindrical when the boot is extended,
said sidewall having an inner surface which is barrel shaped to provide said annular portion of reduced thickness.

5. A push action electrical switch,
comprising a casing having an opening therein,
a push button slidably mounted in said opening,
a contactor movable within said casing and operable by said push button,
resilient means for biasing said push button outwardly,
a mechanism operable by depression of said push button for retaining said push button in a partially depressed position after alternate depressions of said push button,
said mechanism being operative to return said push button to its fully extended position after the intermediate depressions of said push button,
said contactor being movable to one position when said push button is fully extended while being operable to a second position when said push button is partially depressed,
a flexible boot mounted on said casing and disposed around said push button to protect said push button from atmospheric conditions,
and interlocking flange elements on said push button and said boot for causing said boot to follow the movement of said push button,
said boot thereby having an extended position when said push button is fully extended and a partially depressed position when said push button is retained in its partially depressed position,
said boot having an annular sidewall with means thereon for bulging outwardly to form a pronounced convolution when said boot is in its partially depressed position whereby said boot gives a visual indication of the position of said push button and the position of said contactor.

6. A switch according to claim **5**,
in which said interlocking flange elements comprise an annular flange projecting inwardly on the upper portion of said boot,
said push button having flange elements for securing said annular flange therebetween.

7. A switch according to claim **5**,
in which said interlocking flange elements include an annular flange projecting inwardly on the upper portion of said boot,
and a pair of disks on said push button and clamping said annular flange therebetween.

8. A switch according to claim **5**,
in which said means on said annular sidewall comprise an outwardly projecting annular convolution

for bulging outwardly to a pronounced extent when said push button is depressed.

9. A push action electrical switch,
comprising a casing having an opening therein,
a push button slidably mounted in said opening and movable between an extended position and a depressed position,
means for temporarily retaining said push button alternately in said extended position and said depressed position,
a contactor movable within said casing and operable by said push button,
said contactor being operable to one position when said push button is in said extended position while being operable to a second position when said push button is in said depressed position,
a flexible boot mounted on said casing and disposed around said push button to protect said push button from atmospheric conditions,
and means for causing said boot to follow the movement of said push button,
said boot thereby having an extended position when said push button is in its extended position and a depressed position when said push button is retained in its depressed position,
said boot having an annular side wall with an annular portion of reduced thickness,
said annular portion bulging outwardly to form a pronounced convolution when said boot is in its depressed position,
whereby said boot gives a visual indication of the position of said push button and the position of said contactor.

10. A push action electrical switch,
comprising a casing having an opening therein,
a push button slidably mounted in said opening and movable between an extended position and a depressed position,
means for temporarily retaining said push button alternately in said extended position and said depressed position,
a contactor movable within said casing and operable by said push button,
said contactor being operable to one position when said push button is in said extended position while being operable to a second position when said push button is in said depressed position,
a flexible boot mounted on said casing and disposed around said push button to protect said push button from atmospheric conditions,
and means for causing said boot to follow the movement of said push button,
said boot thereby having an extended position when said push button is in its extended position and a depressed position when said push button is retained in its depressed position,
said boot having an annular side wall with means thereon for bulging outwardly to form a pronounced convolution when said boot is in its depressed position,
whereby said boot gives a visual indication of the position of said push button and the position of said contactor.

11. A push action electrical switch,
comprising a casing having an opening therein,
a push button slidably mounted in said opening and movable between an extended position and a depressed position,
means for temporarily retaining said push button alternately in said extended position and said depressed position,
a contactor movable within said casing and operable by said push button,
said contactor being operable to one position when said push button is in said extended position while being operable to a second position when said push button is in said depressed position,
a flexible boot mounted on said casing and disposed around said push button to protect said push button from atmospheric conditions,
and means for causing said boot to follow the movement of said push button,
said boot thereby having an extended position when said push button is in its extended position and a depressed position when said push button is retained in its depressed position,
said boot having an annular side wall with an outwardly projecting annular convolution thereon which is operative to buldge outwardly when said boot is in its depressed position,
whereby said boot gives a visual indication of the position of said push button and the position of said contactor.

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