

United States Patent

[11] 3,596,022

[72] Inventors **Richard B. Gaber**
Forest Park;
Eric H. Petersen, Evergreen Park; Matthew
C. Podgorski, Wood Dale, all of, Ill.

[21] Appl. No. **832,982**

[22] Filed **June 13, 1969**

[45] Patented **July 27, 1971**

[73] Assignee **Chicago Switch, Inc.**
Chicago, Ill.

3,294,932 12/1966 Barlow 200/68
 3,471,663 10/1969 Farrell et al. 200/76

FOREIGN PATENTS

1,081,383 8/1967 Great Britain..... 200/67.7

Primary Examiner—David Smith, Jr.

Attorney—McDougall, Hersh, Scott & Ladd

[54] SWITCH WITH WIPING CONTACT STRUCTURE

9 Claims, 9 Drawing Figs.

[52] U.S. Cl. 200/67

[51] Int. Cl. H01h 13/28

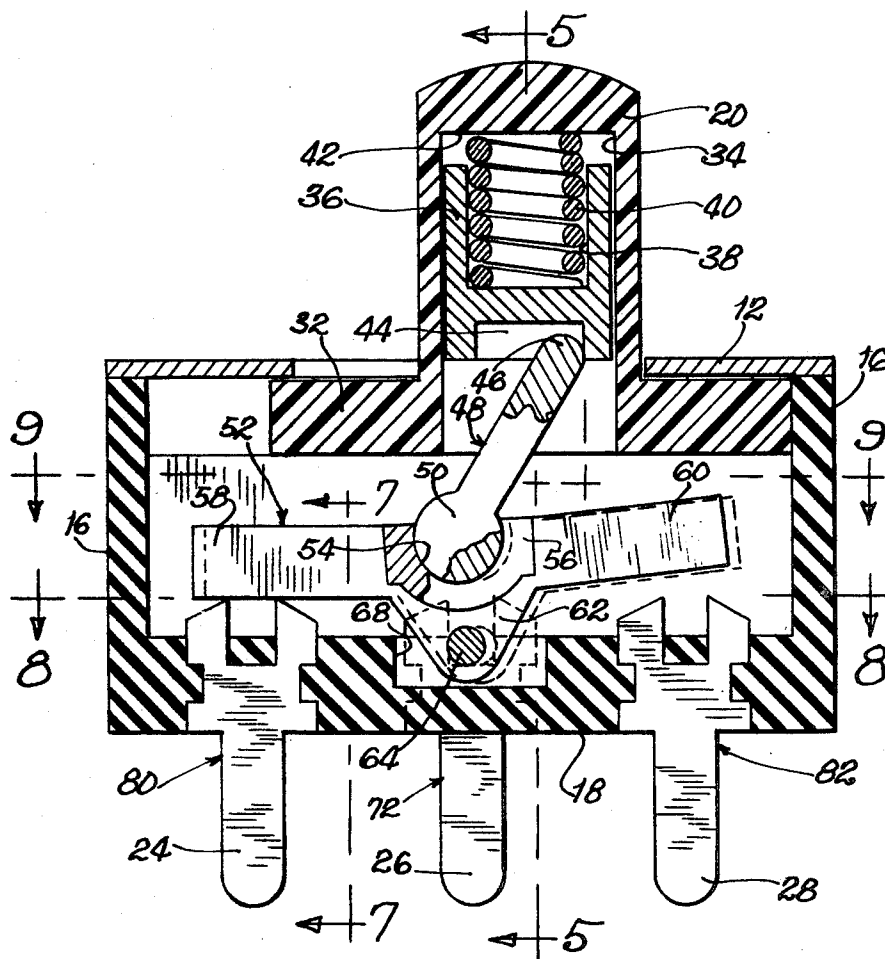
[50] Field of Search. 200/76, 77,
 67.7, 166 B, 68

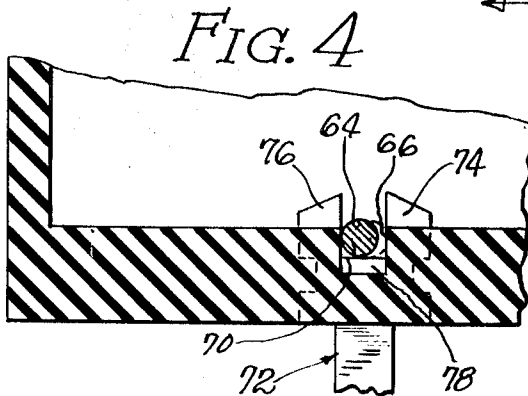
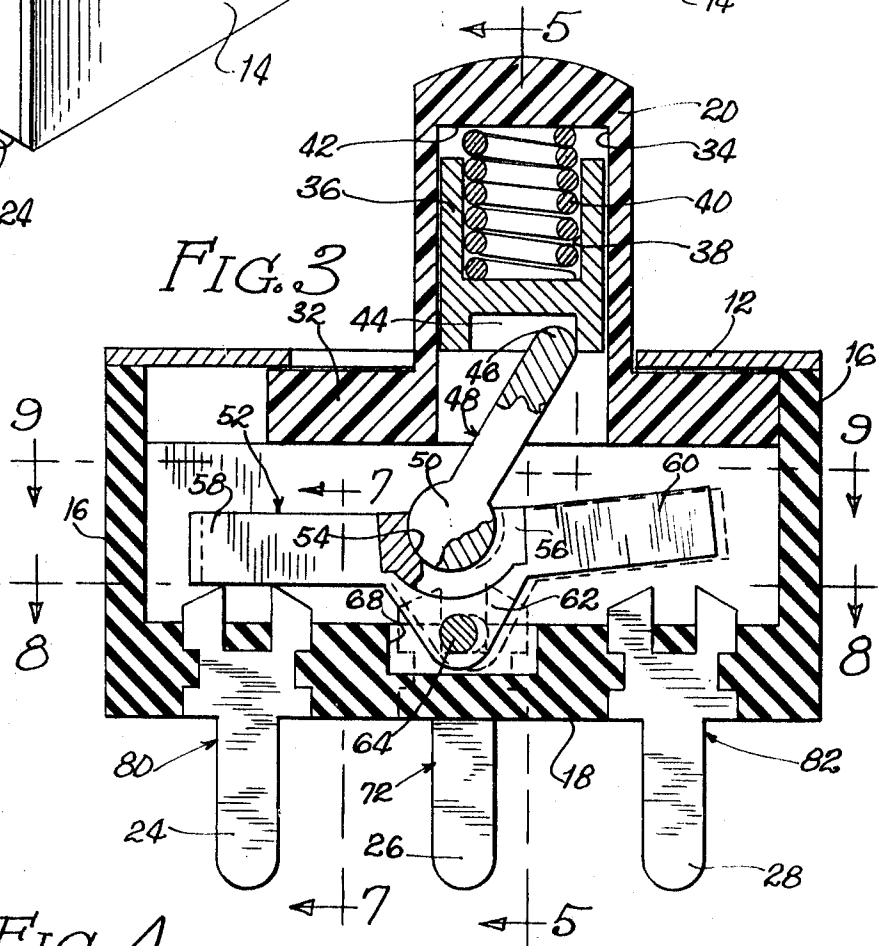
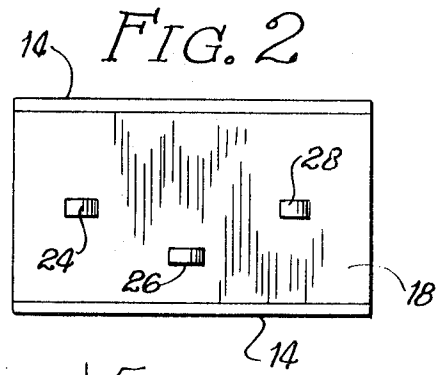
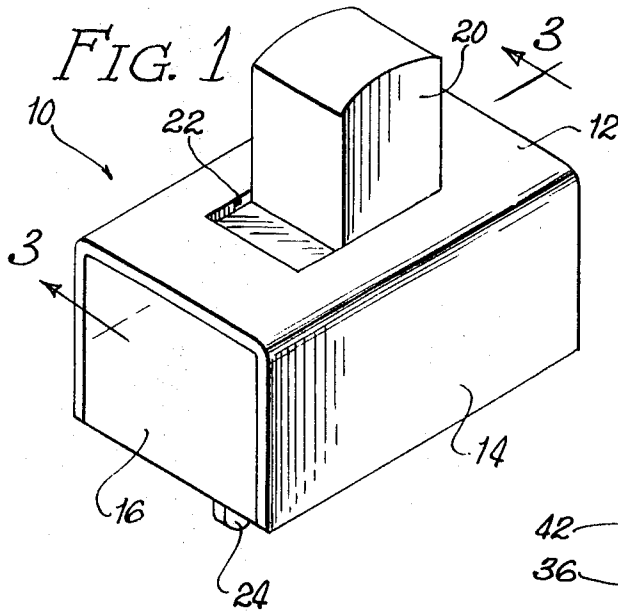
[56] References Cited

UNITED STATES PATENTS

2,248,362 7/1941 Krieger..... 200/67.7 (UX)
 2,548,678 4/1951 Obenour 200/76
 2,790,867 4/1957 Sparr..... 200/67.7 (UX)
 3,189,721 6/1965 Lee 200/166 B8 (UX)

ABSTRACT: A switch construction comprising a base, at least one stationary contact associated with the base and a movable contact in the form of a rocker. The seat supporting the rocker permits pivotal and shifting movement of the rocker when an actuating button is operated. The pivotal movement, through the action of spring means, rapidly makes and breaks the contacts and the shifting movement occurs immediately after the contact engagement to provide wiping action for contact clearing. The stationary contacts comprise bifurcated members to provide double point contact, and the combined hammering and wiping action insures the double contact since the contact points are quickly worn to uniform height. The rocker contact is provided with a pin which engages a common pole contact, this contact also providing support for the rocker pin.





INVENTORS
 Richard B. Gaber
 Eric H. Petersen
 Matthew C. Podgorski
 by *McDougall, Berch, Scott
 and Ladd* Attys

FIG. 5

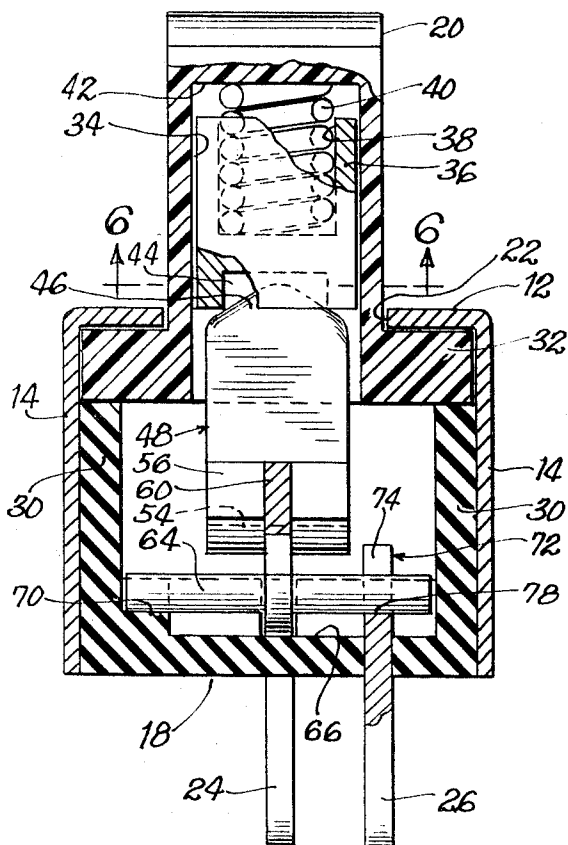


FIG. 6

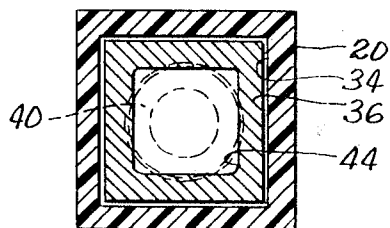


FIG. 7

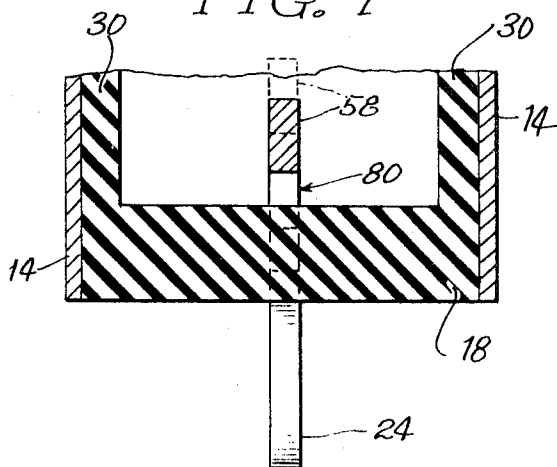


FIG. 8

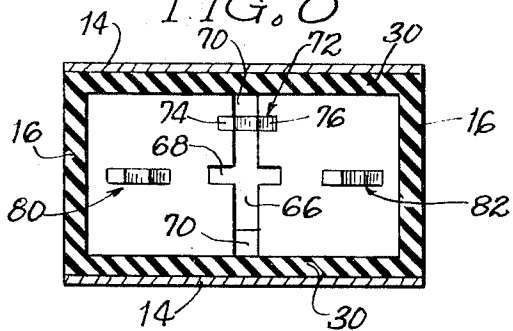
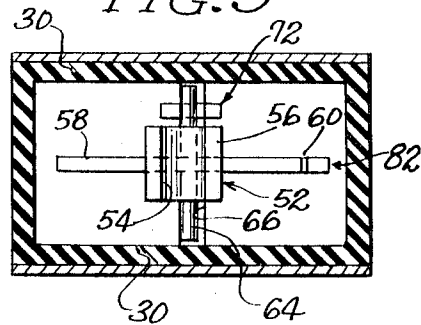


FIG. 9



SWITCH WITH WIPING CONTACT STRUCTURE

This invention relates to an improved switch construction which operates through the use of spring means and which is designed to provide a high degree of reliability and durability. The switch design is preferably of the double throw type for one or more poles, and is particularly suitable for use in low-energy circuits where contact reliability is of critical importance.

It is a general object of this invention to provide a switch construction which includes movable and stationary contacts and highly reliable and durable means for making and breaking the contacts.

It is a more specific object of this invention to provide a switch construction which incorporates wiping action after making of contacts thereby preventing buildup of foreign material on contact surfaces, the wiping action being available even though the switch components are of relatively simple design and can be easily assembled.

It is a further object of this invention to provide a switch construction having minimum contact "bounce," which is adjustable for various applications, which includes highly reliable two-point contact engagement, and which is characterized by a design imparting a high degree of durability.

These and other objects of this invention will appear hereinafter, and for purposes of illustration, but not of limitation, specific embodiments of the invention are shown in the accompanying drawing in which:

FIG. 1 is a perspective view of a switch construction characterized by the features of this invention;

FIG. 2 is a bottom plan view of the switch construction;

FIG. 3 is an enlarged vertical sectional view taken about the line 3-3 of FIG. 1;

FIG. 4 is an enlarged fragmentary view illustrating rocker pin supporting means;

FIG. 5 is a vertical, sectional view taken about the line 5-5 of FIG. 3;

FIG. 6 is a horizontal, sectional view taken about the line 6-6 of FIG. 5;

FIG. 7 is a fragmentary sectional view taken about the line 7-7 of FIG. 3;

FIG. 8 is a horizontal, sectional view taken about the line 8-8 of FIG. 3 with the rocker omitted; and,

FIG. 9 is a horizontal sectional view taken about the line 9-9 of FIG. 3 with the lever omitted.

The switch construction of this invention generally comprises a switch housing including a supporting base. At least two stationary contacts are provided on the base and, in a preferred form of the invention, three such contacts are employed to provide a single pole-double throw switch. A movable contact in the form of a rocker is pivotally supported at least in part by a common pole contact, and actuating means in the form of a pushbutton move the rocker back and forth for engagement with one or the other of the stationary contacts.

The seat for the rocker, in addition to providing pivotal support, is wide enough to allow a shifting movement of the rocker after or substantially simultaneously with the engagement of the rocker arm with a contact to provide a wiping action. The stationary contacts are preferably bifurcated so that the rocker arm will simultaneously engage two contact points. This increases the switch reliability, and has the added benefit of simplifying assembly since the bifurcated contact design provides a desirable design for achieving shifting movement of the rocker, when used as the common contact.

The pushbutton employed for operating the switch includes a spring which applies continuous pressure to the rocker thereby maintaining contact when the switch is in the rest position. When the pushbutton is moved, the pressure imparted to the rocker is actually increased until an "overcenter" position is reached, and at this time, snap action occurs whereby there is rapid disconnect between on rocker arm and one stationary contact, and immediate making of the other rocker arm with the other stationary contact.

FIGS. 1 and 2 illustrate a switch construction 10 comprising a housing which includes top wall 12, sidewalls 14, end walls 16 and bottom wall 18. An actuating pushbutton 20 extends upwardly through the opening 22 defined by the top wall. Three contacts terminals 24, 26 and 28 extend downwardly through the bottom wall. The terminals may be of various types such as a circuit board plug-in type or of the type having means for attaching lead wires.

As best illustrated in the remaining figures, the top wall 12 and sidewalls 14 may be provided by a single U-shaped housing portion which could be conductive or nonconductive. A single molded nonconductive housing portion provides the end walls 16 and bottom wall 18 and also includes upwardly extending interior walls 30. The pushbutton 20 defines a rectangular bottom flange 32 which is supported on the upper edges of the interior walls 30 and which is otherwise confined between the top wall 12 and sidewalls 14. The provision of the flange 32 holds the pushbutton within the housing in all switch positions.

The pushbutton 20 defines a rectangular cavity 34 which receives piston 36. The piston defines a circular bore 38 for holding spring 40. The upper end of the spring bears against the inner surface 42 defined by the cavity 34 and normally urges the piston downwardly.

The bottom end of the piston defines a seat 44 for receiving the upper end 46 of lever 48. As best shown in FIG. 5, the end 46 of the lever defines sloping sides with point contact being provided between these sides and the corners of the seat 44.

The opposite end of the lever comprises a cylindrical section 50 which is received in a corresponding opening 54 defined by a rocker 52. The rocker 52 consists of a conductive element having a central section 56 defining the opening 54 and outwardly extending arms 58 and 60. A downwardly extending portion 62 of the rocker defines an opening for receiving supporting pin 64.

The bottom wall 18 of the construction defines a transverse groove 66 and a communicating longitudinal groove 68. The pin 64 is of a conductive material and has a diameter less than the width of the groove 66 whereby the pin can be received in the groove with freedom for shifting movement. A stepped portion 70 is defined at one end of the groove 66 to provide support for one end of the pin. Contact 27 defining bifurcated portions 74 and 76 is received by the bottom wall and provides support for the opposite end of the pin. As best shown in FIGS. 4 and 5, the midpoint 78 located between the bifurcated portions of the switch 72 provides the support at a level corresponding to the level of the step 70. The terminal 26 comprises an extension of the contact 72.

Contacts 80 and 82 of the same design as the contact 72 are provided at the opposite ends of the switch base 18. The bifurcated ends of these contacts are positioned for engagement by rocker arms 58 and 60, respectively.

In FIG. 3, the switch is shown with the contact arm 58 in engagement with the contact 80. In this condition, the piston 36 is pressing downwardly on the upper end of lever 48, and this pressure is transmitted through the rocker 52 to insure contact in the rest position of the switch.

To achieve switching action, the pushbutton shown in FIG. 3 is moved from right to left. During the initial stages of this movement, the lever 48 offers resistance which causes upward movement of the piston 36 and which results in increased pressure of the rocker arm 58 on the contact 80. This pressure is maintained until an overcenter point is reached, at which time, the force applied to the lever causes pivoting of the rocker. This involves rapid disconnect of the arm 58 with the contact 80, and rapid making of the opposite side of the switch. Thus, the rocker arm 60 will engage the contact 82 substantially immediately after breaking of the other side of the switch.

There are two additional movements involved in the switching operation which provide distinct advantages. Specifically, when the overcenter point is reached, the lever transmits force to the rocker from the opposite side, and the rocker is caused to pivot to the position shown in dotted lines

in FIG. 3, and then shift to the position shown in solid lines. The shifting movement is permitted due to the oversized dimensions of the groove 66, and the opening between the portions 74 and 76 of the contact 72. Thus, the groove and opening are larger in size than the diameter of the pin 64 so that a controlled amount of shifting movement will occur.

The shifting movement has been found to occur substantially immediately after making of the contacts so that the rocker arm will actually wipe across the contact points. This wiping action provides an ideal arrangement since it virtually eliminated the possibility of any foreign substance building up on the contact surfaces. Such substances could, of course, disrupt the electrical conditions and provide an unreliable switch. This particular design also insures that the wiping motion takes an unusually small amount of time, measured in microseconds, which is of great value in many new low-energy applications.

In addition to the shifting movement of the rocker to provide wiping action, the lever 48 is also moved relative to the seat 44 in the piston 36. Thus, after the overcenter point is reached, the end 46 of the lever moves from the right-hand side of the seat 44 as shown in FIG. 3 to the left-hand side of the seat. This arrangement provides maximum application of contact pressure while permitting the use of a more compact switch with a very minimal button movement. Thus, the contact pressure applied through the lever depends upon the angle of the lever axis with the vertical. If the end of the lever were held in one position at the center of the seat 44, then the pressure on the end contact would be less than that achieved by permitting shifting of the lever relative to the seat.

The wiping action and high contact pressure is of particular value in low-energy circuits. Any change in resistance due to the presence of foreign substances or due to low contact pressure are significant problems in such sensitive applications. The arrangement for applying the contact pressure also reduces or eliminates the "bounce" often encountered in snap-action switches, this condition leading to slow resistance changes during switching.

The piston and spring combination employed in association with the lever provides a highly suitable means for adjusting the switch. Where particularly high contact pressure and reduction in bounce is required, then a relatively heavy spring can be employed. On the other hand, longer switch life can be achieved by utilizing a lighter spring, and the structural arrangement makes it quite easy to use different types of springs.

The use of bifurcated contacts in a snap-action switch is also of importance. Substantially increased contact pressure is available where the contact area is small and the arrangement illustrated provides relatively low contact area while still providing two-point support. The provision of wiping action as described is of particular advantage with the bifurcated contact design since, if one point of a contact is higher than another, (which can be expected in new switches) then the wiping action, as well as the hammering action during transfer, will soon wear the higher point down so that two-point contact will be available. The two-point contact is, of course, desirable in the event that, for any reason, conductivity between the rocker and one of the points cannot be achieved.

The use of the contact 72 as the common pole in the switch leads to certain manufacturing advantages. Thus, the bifurcated arms of the contact provide an ideal means for locating and supporting one end of the rocker pin. The contact 72 may be precisely of the same design as the contacts 80 and 82 thereby minimizing inventory and assembly problems. It will be appreciated that in the design shown, the rocker and pin serve as the means for connecting the contacts 80 and 82 with the contact 72, and the rocker design also provides a means for maintaining pressure of the pin on the portion 78 of the contact 72.

The opening 54 which receives the end 50 of the lever is also designed to provide more efficient switch operation. It will be noted that this opening goes beyond a semicircle so that the lever end will be trapped in the opening. It has been

found that parts acting as levers in snap-action switches have a tendency to jump out of seats which are provided for them, and this has sometimes led to malfunction in the switches. With the arrangement illustrated, the lever is securely held by the rocker, and will not become dislodged.

In the manufacture of the rocker, the portion 56 defining the opening 54 may comprise an inset of plastic. With this arrangement, the end 50 of the lever can be snapped into place or it could be assembled by sliding the end sideways into the opening. The section 56 will then also serve as a means for insulating the rocker from other parts of the construction.

It will be understood that various changes and modifications may be made in the above-described construction which provide the characteristics of this invention without departing from the spirit thereof particularly as defined in the following claims.

That which we claim is:

1. In a switch construction including a base, at least one stationary contact associated with said base, and a contact element movable relative to said stationary contact, the improvement wherein said contact element comprises a rocker, a seat defined by said base for supporting the rocker and permitting pivotal movement of the rocker as well as shifting movement toward and away from said stationary contact, switch-actuating means for imparting movement to the rocker, comprising a pushbutton, said means for holding said rocker in said one position and in said second position comprising resilient means associated with said pushbutton, and including a lever interposed between said rocker and said resilient means, a seat defined by said resilient means for receiving the upper end of said lever, said upper end having bearing contact with said seat with said seat pressing vertically downwardly thereon whereby the force applied by said resilient means is transmitted through said lever to said rocker, and wherein said upper end of the lever is adapted to shift from one side of said seat to the other during a switching operation to thereby increase the horizontal pressure applied by said resilient means to said rocker when the switch is in a position of rest, means for holding said rocker against a stationary contact in at least one position of the rocker and for holding said rocker away from said stationary contact in a second position of the rocker, and wherein movement of said rocker by said actuating means from said second position to said first position results in engagement of the rocker with said stationary contact and substantially simultaneous shifting of the rocker for wiping of the stationary contact by the rocker.

2. A construction in accordance with claim 1 comprising a single pole—double throw switch, said rocker including oppositely directed arms for alternately engaging contacts at the opposite ends of said switch, and a third contact comprising a common pole for the switch.

3. A construction in accordance with claim 2 wherein said rocker is formed of conductive material, a pin attached to said rocker and defining the pivot axis of the rocker, said pin also being formed of conductive material and wherein said third contact serves as a support for the pin.

4. A construction in accordance with claim 3 wherein said contacts comprise bifurcated members with each of the end contacts providing two points of engagement for each rocker arm.

5. A construction in accordance with claim 4 wherein said third contact is identical in structure with said end contacts and wherein the bifurcated arms of said third contact provides a seat for said pin, the distance between the arms of said third contact being greater than the diameter of said pin whereby the amount of shifting movement permitted is determined by the freedom of movement of the pin relative to said arms.

6. A construction in accordance with claim 1 wherein said lever defines a cylindrical bottom end, an opening defined by said rocker for receiving said cylindrical end, said opening having a cross section extending beyond a semicircle whereby said cylindrical end is trapped by said rocker.

7. In a switch construction including a base, at least one stationary contact associated with said base, and a contact element movable relative to said stationary contact, the improvement wherein said contact element comprises a rocker having at least one longitudinally extending conductive arm, a seat defined by said base for supporting the rocker, said seat comprising a conductive element transversely offset relative to said longitudinally extending arm and including a bifurcated upper end portion, and a separate bearing portion of said seat also transversely offset relative to said arm and positioned on the opposite side of said arm, a conductive pin attached to said rocker and extending transversely on either side of the rocker with one end of the pin positioned on said seat within the opening defined by the bifurcated portion of said contact element, and with the other end of the pin engaging said separate bearing portion, switch-actuating means for imparting movement to the rocker, resilient means for holding said rocker against the stationary contact in at least one position of the rocker and for holding said rocker away from said stationary contact in a second position of the rocker, said pin having a width less than the size of said opening to permit shifting movement of the pin within said opening, and wherein said resilient means operates to apply longitudinal force to said rocker, whereby movement of said rocker by said actuating means from said second position to said one position results in engagement of the arm of said rocker with said stationary contact and substantially simultaneous longitudinal shifting movement of said rocker relative to said seat whereby said arm undergoes wiping engagement with said stationary contact.

8. In a single pole—double throw switch construction including a base, stationary contacts in spaced positions on said base, and a contact element movable relative to said stationary contacts, said movable contact element comprising a rocker, the improvement wherein said rocker is formed of conductive material, a pin attached to said rocker and defining the pivot axis of the rocker, said pin also being formed of conductive material, and including a third contact located between said stationary contact and serving as a seat for the pin and thereby supporting the rocker and permitting pivotal movement of the rocker as well as longitudinal shifting movement toward and away from said stationary contact, each of said contacts comprising bifurcated members with each of the end contacts providing two points of engagement for each rocker arm, said third contact being identical in structure with said end contacts and wherein the bifurcated arms of said third contact provide said seat for said pin, the distance between the arms of said third contact being greater than the thickness of said pin whereby the amount of shifting movement permitted is determined by the freedom of movement of

the pin relative to said arms, said third contact being laterally offset with respect to a line extending between said stationary contacts and providing support for one end of said pin, and including a groove defined by said switch base, a bearing surface formed at one end of said groove on the side of the switch opposite said third contact for supporting the opposite end of said pin, the width of said groove in the area of said seat corresponding with the spacing between the arms of said third contact, switch-actuating means for imparting movement to the rocker, means for holding said rocker against one stationary contact in at least one position of the rocker and for holding said rocker away from the other stationary contact in a second position of the rocker, and wherein movement of said rocker by said actuating means from said second position to said first position results in engagement of the rocker with the one stationary contact and substantially simultaneous shifting of the rocker for wiping of the stationary contact by the rocker.

9. In a switch construction including a base, at least one stationary contact associated with said base, and a contact element movable relative to said stationary contact, the improvement wherein said contact element comprises a rocker, a seat defined by said base for supporting the rocker and permitting pivotal movement of the rocker as well as shifting movement toward and away from said stationary contact, switch-actuating means for imparting movement to the rocker comprising a push button, means for holding said rocker against a stationary contact in at least one position of the rocker and for holding said rocker away from said stationary contact in a second position of the rocker, said means for holding said rocker in said one position and in said second position comprising resilient means associated with said pushbutton, and including a lever interposed between said rocker and said resilient means, a seat defined by said resilient means for receiving the upper end of said lever, and wherein said upper end of the lever is adapted to shift from one side of said seat to the other during a switching operation to thereby increase the horizontal pressure applied by said resilient means to said rocker when the switch is in a position of rest, and wherein said lever defines a cylindrical bottom end, an opening defined by said rocker for receiving said cylindrical end, said opening having a cross section extending beyond a semicircle whereby said cylindrical end is trapped by said rocker, said rocker including a centrally located insert formed of insulating material, the opening for receiving said cylindrical end being defined by said insert, and wherein movement of said rocker by said actuating means from said second position to said first position results in engagement of the rocker with said stationary contact and substantially simultaneous shifting of the rocker for wiping of the stationary contact by the rocker.

55

60

65

70

75