

Jan. 17, 1967

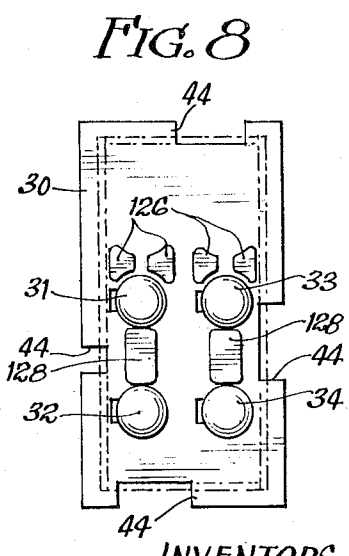
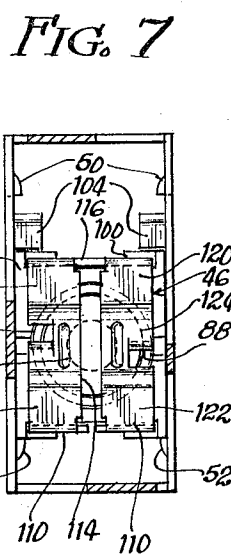
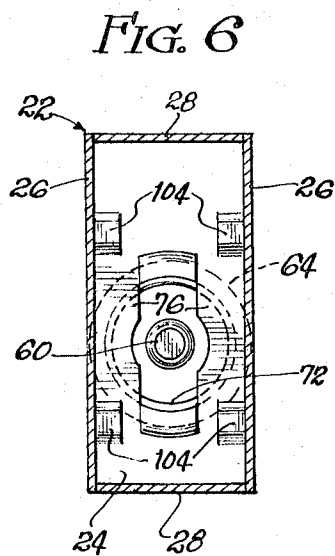
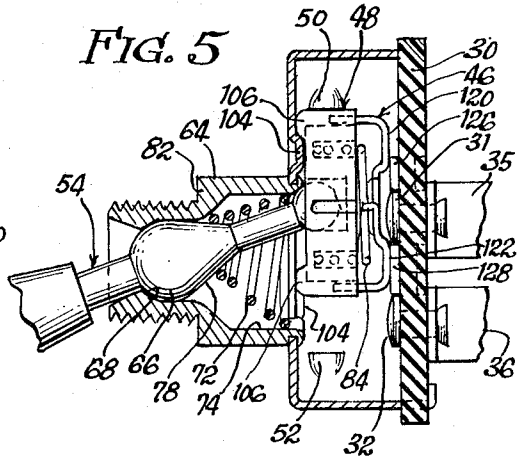
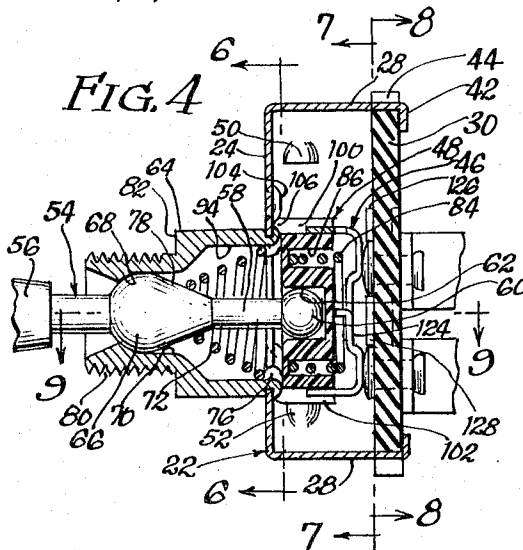
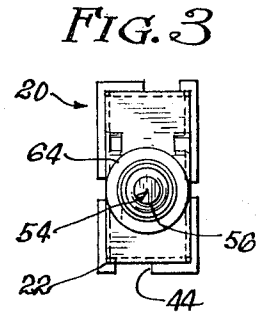
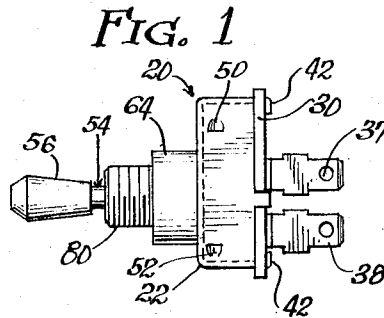
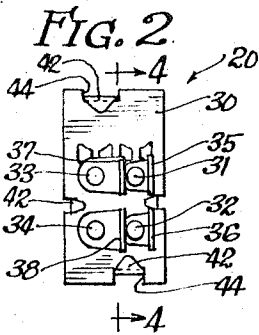
W. J. SCHAAD ETAL

3,299,227

ELECTRICAL SWITCHES WITH IMPROVED CONTACT AND DETENT STRUCTURES

Filed Feb. 14, 1966

3 Sheets-Sheet 1



INVENTORS
 William J. Schaad
 William N. Schink
 by McDougall, Hersh, Scott
 and Ladd Attys

Jan. 17, 1967

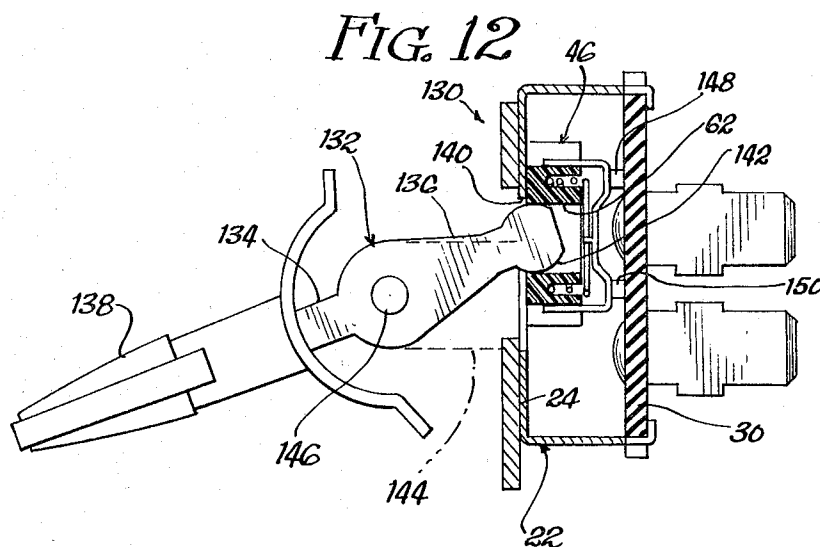
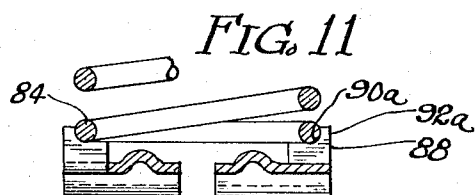
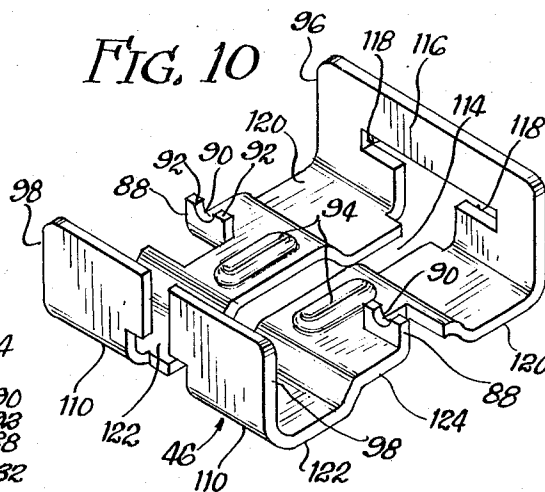
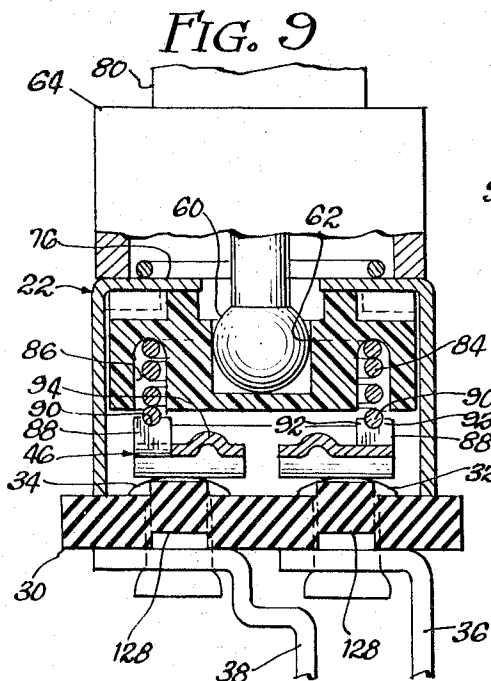
W. J. SCHAAD ETAL

3,299,227

ELECTRICAL SWITCHES WITH IMPROVED CONTACT AND DETENT STRUCTURES

Filed Feb. 14, 1966

3 Sheets-Sheet 2



INVENTORS
 William J. Schaad
 William N. Schink
 by McDougall, Hersh, Scott
 and Ladd Attys

Jan. 17, 1967

W. J. SCHAAD ETAL

3,299,227

ELECTRICAL SWITCHES WITH IMPROVED CONTACT AND DETENT STRUCTURES

Filed Feb. 14, 1966

3 Sheets-Sheet 3

FIG. 13

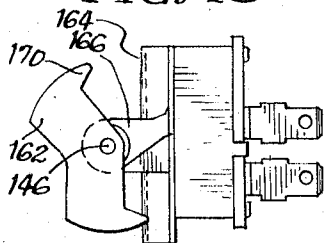


FIG. 14

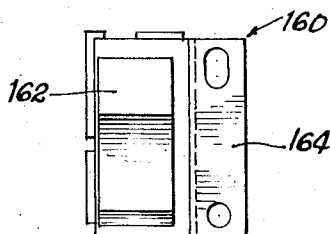


FIG. 15

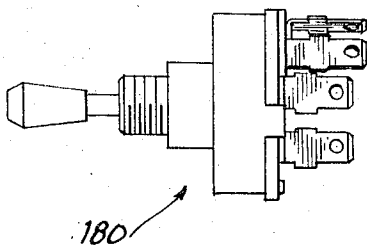


FIG. 16

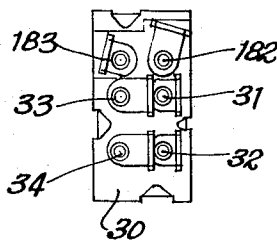


FIG. 20

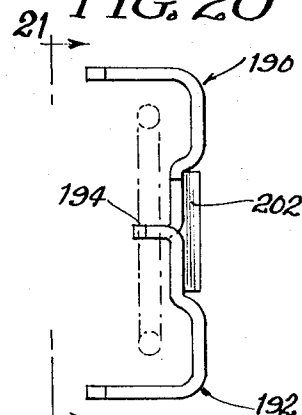


FIG. 17

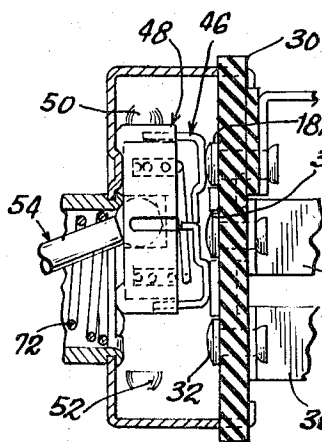


FIG. 18

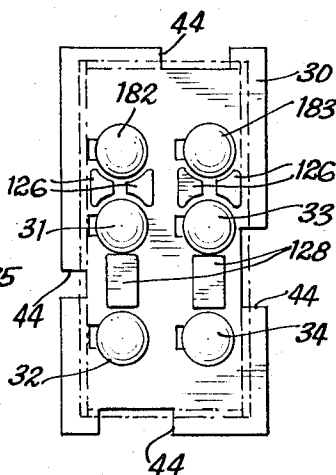


FIG. 21

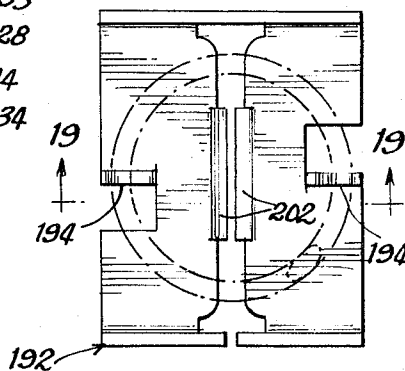
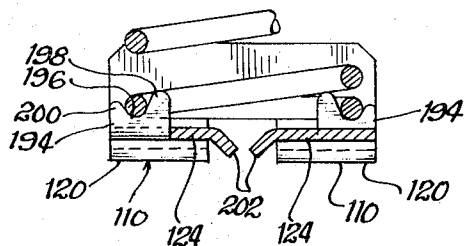


FIG. 19



INVENTORS
William J. Schaad
William N. Schink
by McDougall, Hersh, Scott
and Ladd Attys

1

3,299,227

ELECTRICAL SWITCHES WITH IMPROVED CONTACT AND DETENT STRUCTURES

William J. Schaad, Glenview, and William N. Schink, Crystal Lake, Ill., assignors to Indak Manufacturing Corp., Northbrook, Ill., a corporation of Illinois
Filed Feb. 14, 1966, Ser. No. 527,270
20 Claims. (Cl. 200—16)

The present invention is an improvement upon the electrical switch disclosed and claimed in the applicants' co-pending application, Serial No. 317,327, filed October 18, 1963, now Patent No. 3,235,679, patented February 15, 1966.

This invention relates to electrical switches generally and pertains particularly to improved electrical switches which are especially well adapted for use in automobiles, trucks and other automotive vehicles.

One object of the present invention is to provide a switch which is constructed in a new and improved manner so as to be capable of establishing a four-way make, whereby four points of contact are positively and dependably connected together.

A further object is to provide a new and improved switch of the foregoing character, having a contactor comprising a plurality of flexibly interconnected bars, together with an arrangement whereby a single spring is capable of biasing the bars against the contact points of the switch, while also acting as a detent spring.

It is a further object to provide such a new and improved switch in which spring seats are provided on the contactor bars, to insure that the pressure of the spring will be applied effectively to each of the bars.

Another object is to provide such a new and improved switch in which the bars of the contactor are flexibly interconnected at one end by a transverse bar or web which is combined with one of the guide tabs for the contactor in such a manner as to provide increased flexibility, as well as an extremely compact construction.

Another object is to provide an electrical switch having a new and improved spring arrangement for retaining the operating lever of the switch and preventing the lever from rattling or vibrating.

A further object is to provide an electrical switch which is improved in construction and operation yet is reduced in cost.

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

FIG. 1 is a side elevational view of an electrical switch to be described as an illustrative embodiment of the present invention.

FIG. 2 is a rear view of the switch.

FIG. 3 is a front view.

FIG. 4 is a fragmentary enlarged longitudinal section taken generally along the line 4—4 in FIG. 2, the switch being shown in its On position.

FIG. 5 is a fragmentary view similar to FIG. 4 but showing the switch in its Off position.

FIG. 6 is a sectional view with the movable carriage of the switch removed, the view being taken generally along the line 6—6 in FIG. 4.

FIG. 7 is a section taken generally along the line 7—7 in FIG. 4.

FIG. 8 is a view showing the front or inner side of the contact mounting plate, the view being taken generally as indicated by the line 8—8 in FIG. 4.

FIG. 9 is a fragmentary enlarged end view, partly in section along the line 9—9 in FIG. 4.

FIG. 10 is an enlarged perspective view showing the contactor of the switch.

2

FIG. 11 is a fragmentary sectional view similar to a portion of FIG. 9 but showing a modified contactor construction.

FIG. 12 is a sectional view somewhat similar to FIG. 5 but showing a modified switch construction.

FIG. 13 is an elevational view somewhat similar to FIG. 1 but showing another modified switch construction.

FIG. 14 is a front view of the modified switch of FIG. 13.

FIGS. 15 and 16 are side and rear elevational views which are similar to FIGS. 1 and 2, but illustrate still another modified switch.

FIG. 17 is a sectional view similar to FIG. 5 but showing the modified switch of FIGS. 15 and 16, the view being taken generally along the line 17—17 in FIG. 16.

FIG. 18 is a view similar to FIG. 8 but showing the modified switch of FIGS. 15 and 16, the view being taken generally as indicated by the line 18—18 in FIG. 17.

FIG. 19 is a fragmentary sectional view similar to FIG. 11 but showing another modified construction.

FIG. 20 is a side elevational view of the modified contactor as shown in FIG. 19.

FIG. 21 is a front elevational view of the modified contactor of FIGS. 19 and 20.

The invention is applicable to switches generally, but will be illustrated, by way of example, in connection with an emergency stop signal switch 20, as shown in FIGS. 1—10, intended particularly for automotive service. The emergency stop signal switch 20 is intended to be used, in conjunction with a flasher, to cause the left and right turn signal lamps, at both the front and rear ends of the automobile or other automotive vehicle, to flash simultaneously. In this way, other motorists are warned that the vehicle is disabled or has been stopped to meet some emergency. To bring about the flashing of all four signal lamps, the switch is adapted to establish a four-way make, whereby four contact points or the like are connected together simultaneously. In certain of its aspects, the present invention is particularly applicable to four-way make switches, and to other switches in which more than four contact points are connected together simultaneously. Such four-way make switches are employed in emergency stop signal circuits and various other circuits employed in automotive vehicles and other applications.

The illustrated switch 20 comprises a casing 22 which is made of metal but could be made of plastics or other suitable materials. As shown, the casing 22 is rectangular in shape, but might be of various shapes. Thus, the illustrated casing 22 comprises a front wall 24, a pair of sidewalls 26, and a pair of end walls 28. The rear side of the casing 22 is closed by a plate or other similar member 30, adapted to support a plurality of contacts. Four such contacts 31—34 are employed in the present construction, but the number of contacts can be varied.

As shown, each of the contacts 31—34 is in the form of a rivet which extends through the contact supporting plate 30. The plate 30 is preferably made of insulating material. A plurality of lugs or other terminals 35—39 are secured to the contacts 31—34 and are mounted on the rear or outer side of the plate 30.

The contact supporting plate 30 is secured in some suitable manner to the casing 22. As shown, the casing 22 is provided with a plurality of tabs 42 which project rearwardly from the casing, through slots or notches 44 formed on the plate 30. The tabs 42 are bent or clinched inwardly, behind the plate 30.

The switch 20 is provided with a contactor 46 which is adapted to engage the contact points 31—34. A movable carriage 48 is provided to support the contactor 46. The carriage 48 is preferably made of plastic or some other insulating material. In this case, the carriage 48 is slid-

able longitudinally within the casing 22 and along the front wall 24. The side walls 26 act as longitudinal guides for the carriage 48.

In this instance, stops 50 and 52 are preferably provided within the casing 22 to limit the longitudinal movement of the carriage 48. In the illustrated construction, the stops 50 and 52 are struck inwardly from the side walls 26. However, the casing 22 could be made shorter, in which case the stops would not be needed.

A lever 54 is preferably employed to actuate the carriage 48. As shown, the lever 54 comprises an outer arm or handle 56 and an inner arm 58. The carriage 48 is connected to the end of the inner arm 58. Preferably, the inner arm 58 has a ball-shaped end portion 60 which is fitted into a generally circular socket or opening 62 formed in the front side of the carriage 48. The carriage 48 has a wall or web 63 which closes the rear end of the socket 62, to prevent the lever from touching the contactor 46.

In the illustrated construction, the operating lever 54 is mounted in a bushing or stem 64 which is secured to the front wall 24 of the casing 22. The bushing 64 provides a pivotal support for the lever 54. Preferably, the lever 54 extends through a slot 71 which is formed in the front is received in a socket 68, within the bushing 64. The socket 68 is formed near the front end of a bore 70 which extends longitudinally through the bushing. The lever 54 extends through a slot 71 which is formed in the front wall 24 of the casing 22, behind the bushing 64.

A spring 72 is provided within the bushing 64 to bias the ball-shaped member 66 against the socket 68. The spring 72 is housed within an enlarged bore 74, formed in the rear portion of the bushing 64. As illustrated, the spring 72 is in the form of a conical or tapered coil spring which is compressed between the lever 54 and the wall 24, which has the shoulder portions 76 behind the rear end of the bushing 64. The smaller end of the conical spring 72 is directed toward the front of the switch and is received around a conical portion 78 formed on the rear end of the ball-shaped member 66. The larger rear end portion of the conical spring 72 engages the shoulder or seat 76 and is of a diameter corresponding to that of the bore 74.

It will be understood that the conical spring 72 retains the lever 54 within the bushing 64. Moreover, the spring 72 presses the ball-shaped member 66 firmly against the seat 68 and thus prevents the lever 54 from rattling or vibrating due to the movement of the vehicle. Such rattling would be highly objectionable.

The bushing 64 has a reduced front portion 80 which is externally threaded to receive a mounting nut, whereby the bushing may be mounted on a panel or bracket. A shoulder 82 is formed on the bushing to the rear of the threaded portion 80.

In accordance with one of the features of the present invention, the contactor 46 is biased rearwardly, against the contact points 31-34 and the insulating plate 30, by a single spring 84 which is compressed between the contactor 46 and the carriage 48. An annular socket 86 is formed in the rear side of the carriage 48 to receive the spring 84. One or more spring seats 88 are preferably formed on the contact 46 to receive the spring 84, so as to assure that the pressure of the spring will be properly applied to the contactor. As shown to best advantage in FIGS. 9 and 10, the illustrated spring seats 88 are in the form of tabs which are struck from the contactor and are bent toward the front of the switch. A groove or recess 90 is formed in each of the tabs or seat members 88 to receive and locate the rear coil of the spring 84. The grooves 90 of FIGS. 9 and 10 are generally of a semi-circular shape. Thus, each tab 88 is formed with a pair of prongs 92, on opposite sides of the grooves 90, to retain the rear coil of the spring 84.

FIG. 11 illustrates a slightly modified construction in

which each tab 88 is formed with a spring-receiving recess 90a of a rounded L-shape. In this case, each tab 88 is formed with only one prong 92a, on the outer side of the recess 90a, to retain the front coil of the spring 84.

Reinforcing ribs 94 may be formed on the contactor 46 adjacent the spring seat tabs 88. These ribs 94 stiffen the contactor and afford resistance to bending at the points where the tabs 88 are formed.

The contact 46 is retained on the carriage 48 by a plurality of tabs or lugs 96 and 98 which are bent at right angles from the contactor and extend from the front of the switch. Slots or notches 100 and 102 are formed in the opposite ends of the carriage 48 to receive the tabs 96 and 98. In this way, the contactor is guided for forward and rearward movement relative to the carriage 48. Thus, the contactor can ride up and over the contact points 31-34 as the carriage 48 is moved longitudinally.

In addition to biasing the contactor 46 rearwardly against the contacts points 31-34, the spring 84 biases the carriage 48 forwardly against the front wall 24 of the casing 22. Detent elements are preferably provided on the wall 24 and the carriage 48 to detain the carriage in its various operating positions. The illustrated switch has only two operating positions, the On position of FIG. 4 and the Off position of FIG. 5. In moving between these positions, the carriage 48 rides over a set of four detent projections 104 extending rearwardly from the front wall 24. Similar detent projections 106 extend forwardly from the carriage 48, to engage the projections 104. Recesses 107 are formed in the carriage 48 to afford clearance for the tabs 88 when the carriage is moved rearwardly by the detents 104 and 106.

In order to provide for the establishment of a four-way make, the contactor 46 is preferably split or divided into a plurality of bars or legs. Each bar is adapted to engage one or more of the individual contact points. The illustrated contactor 46 comprises two such bars 110. A slot 114 is formed in the contactor 46 between the bars 110. In the illustrated construction, the slot 114 extends entirely through the tab or lug 98 so as to divide such tab into two separate portions, one extending forwardly from each of the bars 110.

In the illustrated construction, one of the bars 110 is adapted to engage the contacts 31 and 32, while the other bar 110 is engageable with the contact points 33 and 34. The coil spring 84 presses the bars 110 against the corresponding contact points. The pressure of the spring is applied to the bars by the spring seat members or tabs 88, one of which is formed on each of the bars 110. The provision of the spring seat members 88 insures that the pressure of the spring will be divided between the bars 110. While the contacts 31 and 32 are shown as being directly opposite the contacts 33 and 34, they could be staggered, to minimize false detenting action, as disclosed and claimed in the Schink Patent No. 3,188,697, patented June 15, 1965.

A flexible connecting web or transverse bar 116 is formed between the bars 110, so as to provide for relative rocking movement between the bars. The flexible connection between the two bars 110 makes it possible for the bars to engage all four of the contact points 31-34 solidly, with substantially uniform distribution of contact pressure among the four contact points. In some of the prior four-way make switches known to the art, difficulty has been experienced with teetering of the contactor relative to the four contact points, due to slight irregularities in the shape of the contactor or the height of the contact points. This teetering action is similar to that often experienced with a four-legged table or other article of furniture. The flexible connection provided between the bars 110 of the present switch makes it possible for the contactor to adjust itself to the four contact points 31-34 so that all of them will be engaged solidly.

In the illustrated construction, the transverse connect-

5

ing web or bar 116 is combined with the tab 96 which projects forwardly from one end of the contactor 46. For increased flexibility, the slot 114, disposed between the bars 110, is extended part way along the tab 96 so that the connecting web 116 is of less width than the tab 96. The length of the connecting web 116 is increased by providing lateral slots 118 branching sideways from the end of the slot 114. The increased length of the connecting web 116 increases its flexibility, so as to provide a softer spring connection between the two bars 110.

To provide for engagement with the contact points 31-34, each of the bars is formed with rearwardly offset end portions or bosses 120 and 122, disposed at the opposite ends of the bars. Each bar 110 has a central portion 124 which is offset forwardly relative to the end portions 120 and 122, so as to be spaced forwardly away from the contact points 31-34 during the operation of the switch. The spring seat tabs 88 and the stiffening ribs 94 are formed on the central portion 124 of each bar 110.

The operation of the switch is illustrated to best advantage in FIGS. 4 and 5. FIG. 4 illustrates the switch in its On position, in which all four of the contact points 31-34 are engaged by the contactor 46. The rearwardly offset end portions 120 and 122 of the bars 110 engage the contact points 31-34 which are preferably of a spherically rounded shape. The narrow elongated bar or web 116 extending transversely between the bars 110 makes it possible for the bars to rock relative to each other so that all four of the contact points 31-34 will be solidly engaged. Such rocking movement of the bars 110 causes twisting or torsional deflection of the transverse web 116. The length and narrowness of the transverse web 116 increases its torsional flexibility. The provision of the lateral slots 118 increases the length of the connecting web 116. It will be noted that the width of the connecting web 116 is substantially less than the length of the tab 96 so as to increase the torsional flexibility of the web. Moreover, the transverse web or bar 116 is at the extreme end of the tab 96 so as to be spaced as far as possible from the bars 110. Thus, the bars 110 have maximum leverage in causing torsional deflection of the web 116.

The bars 110 are pressed against the contact points 31-34 by the single compression coil spring 84. The pressure of the spring is transferred to the bars 110 by the spring seat members or tabs 88, which engage the rear coil of the spring. The recesses 90 in the tabs 88 are effective to retain the spring 84 in its proper position.

FIG. 5 illustrates the switch in its Off position, in which the contactor 46 is out of engagement with the contact points 31-34. It will be noted that the lever 54 has been swung in a counterclockwise direction so as to move the contactor 46 upwardly. Thus, the rearwardly offset end portions 120 and 122 of the contactor are moved out of alignment with the contact points. The upper contact points 31 and 33 are opposite the forwardly offset central portions 124 of the contactor bars 110.

Preferably, the contact supporting member or plate 30 is formed with insulating bosses or points 126 and 128 which are engageable by the rearwardly offset portions 120 and 122 of the contactor when the switch is in its Off position. The insulating bosses 126 and 128 project forwardly from the plate 30 but are preferably of a height somewhat less than that of the contact points 31-34. It is preferred to form the insulating bosses 126 and 128 as semi-perforations or extrusions from the insulating plate 30. The provision of the insulating bosses 126 and 128 facilitates the smooth movement of the contactor between its Off and On positions. Moreover, the insulating bosses 126 and 128 hold the contactor away from the contact points 31-34 by an in-

6

creased amount when the switch is in its Off position.

When the switch is operated between its Off and On positions, the rearwardly projecting portions 120 and 122 of the bars 110 ride up onto the contact points 31-34 so that all four of the contact points will be connected together by the contactor. The bars 110 are free to rock to an appreciable extent relative to each other, due to the provision of the flexible transverse web 116 between the bars.

The conical spring 72 presses the ball portion 66 of the lever 54 into its socket 68 and prevents the lever from rattling or vibrating, in both the Off and On positions of the switch. The web or wall 63 at the rear end of the socket 62 prevents the lever from being pushed against the contactor 46, which might cause a short circuit.

FIG. 12 illustrates a modified switch 130 which is the same in most respects as the switch 20. Corresponding components of the two switches have been given the same reference characters. However, in the switch 130, the lever 54 is replaced with a lever 132 which is made of sheet metal or other flat material. The lever 132 has outer and inner arms 134 and 136. It will be seen that a handle 138 is mounted on the outer arm 134. The inner arm 136 extends into the casing 22 through a slot 140 which is formed in the front wall 24. The inner arm 136 has a rounded end portion 142 which is received in the socket or opening 62, formed in the carriage 48.

The lever 132 is mounted on a bracket 144 which is welded or otherwise secured to the casing 22. A rivet or other pivot member 146 is employed to connect the lever 132 to the bracket 144.

The modified switch 130 is provided with insulating bosses or semi-perforations 148 and 150 which project forwardly from the insulating plate 30. As before, the contactor 46 engages the insulating bosses 148 and 150 when the switch is in its Off position, as shown in FIG. 12. When the switch is operated to its On position, the contactor rides from the insulating bosses 148 and 150 onto the contact points 31-34.

FIG. 13 and 14 illustrate another modified switch 160 which may have the same internal construction as the switch 130 of FIG. 12. However, the external lever arm 134 and handle 138 of FIG. 12 are replaced with a rocker 162 which is swingable about the pivot 146 and is connected to the rearwardly extending lever arm 136. The rocker 162 may be made of plastics, metal or other suitable material.

It will be seen that the modified switch 160 has a mounting bracket 164 which is formed with a forwardly projecting arm 166 to support the pivot 146. The rocker 162 is formed with a pair of stop fingers 168 and 170 which are engageable alternately with the mounting bracket 164 to limit the swinging movement of the rocker. In all other respects, the modified switch 160 of FIGS. 13 and 14 may be the same as the switch 130 of FIG. 12.

FIGS. 15-18 illustrate still another modified switch 180 which is substantially the same as the switch 20 of FIGS. 1-10, except that the switch 180 is provided with two extra contacts 182 and 183 which are mounted on the insulating board 30, above the contacts 31 and 33. As shown to best advantage in FIG. 17, the contactor 46 is movable into engagement with the extra contacts 182 and 183, so as to form a closed circuit therebetween, when the contactor is moved upwardly, out of engagement with the contacts 31-34. It will be seen that the rearwardly offset portions 120 of the contactor bars 110 are engageable with the contacts 182 and 183.

Thus, instead of having Off and On positions, the modified switch 180 of FIGS. 15-18 has two operating positions, one of which is shown in FIG. 17. In this operating position, the contactor 46 is moved upwardly so as to engage the contacts 182 and 183, and thereby form a closed circuit therebetween. In this position of the con-

tactor, the rearwardly offset portions 122 of the contactor bars 110 engage the insulating bosses or seim-perforations 128. The contactor 46 is completely out of engagement with the contacts 31-34. In the other operating position of the switch 180, the contactor 46 is moved downwardly into engagement with all four of the contacts 31-34, as in the case of the switch 20 of FIGS. 1-10. This position of the modified switch corresponds to the position shown in FIG. 4. In this position, the contactor 46 is out of engagement with the contacts 182 and 183.

FIGS. 19-21 illustrate a modified switch 190 which has a modified contactor 192, but otherwise is the same as the switch 20 of FIGS. 1-10. The modified contactor 192 has modified spring seat members or tabs 194 which replace the tabs 88 of FIGS. 1-10. It will be seen that each of the tabs 194 is formed with a groove or recess 196 which is disposed between two rounded prongs or projections 198 and 200. In this case, the prong 198 projects a greater distance forwardly from the contactor, than does the prong 200. It will be understood that the rear-most coil of the spring 84 is seated in the recesses 196, while the prongs 198 project into the open rear end of the spring. Thus, the coil spring 84 is accurately and securely retained on the contactor 192. As before, the spring seat tabs 194 transmit the force of the spring to the individual contactor bars 110.

In the modified contactor 192 of FIGS. 19-21, the reinforcing ribs 94 of FIGS. 1-10 are replaced by reinforcing or stiffening flanges 202 which are formed on the inner edges of the contactor bars 110, opposite the spring seat tabs 194. The flanges 202 extend along the rearwardly offset portion 124 of the bars 110. As illustrated, the flanges 202 are inclined at a diagonal slant. The illustrated flanges 202 angle forwardly from the rearwardly offset portions 124, but extend forwardly to a lesser extent than the forwardly offset portions 120 and 122 of the contactor bars 110. The flanges 202 have the effect of stiffening the contactor bars 110 so that they will resist the tendency to bend at the cutouts formed by the spring seat tabs 194.

Various other modifications, alternative constructions and equivalents may be employed without departing from the true spirit and scope of the invention, as exemplified in the foregoing description and defined in the following claims.

We claim:

1. In an electrical switch, the combination comprising a casing, an insulating carriage movable in said casing, means for moving said carriage, an insulating member mounted on said casing opposite one side of said carriage, a plurality of contacts mounted on said insulating member, a conductive contactor mounted on said carriage and movable into engagement with said contacts, a coil spring compressed between said carriage and said contactor, and a plurality of individual seat members in the form of distinct projections formed integrally with said contactor and projecting therefrom toward said carriage, said seat members having recesses therein for receiving and locating said spring to transmit the force of said spring to said contactor.
2. A combination according to claim 1, in which said seat members comprise tabs formed integrally with said contactor and bent therefrom toward said carriage.
3. A combination according to claim 1, in which said seat members are in the form of tabs formed integrally with said contactor and bent therefrom toward said carriage, said tabs having grooves therein for receiving the coil at the end of said spring.

4. In an electrical switch, the combination comprising a casing, an insulating carriage movable in said casing, means for moving said carriage, an insulating member mounted on said casing opposite one side of said carriage, a plurality of contacts mounted on said insulating member, a conductive contactor mounted on said carriage and having a plurality of bars movable into engagement with said contacts, said contactor having a flexible web portion formed integrally with said bars and extending as the sole connection therebetween whereby said bars are rockable relative to each other, a single coil spring compressed between said carriage and said contactor for biasing said bars against said contacts, and a plurality of seat members formed integrally with said respective bars of said contactor and projecting therefrom toward said carriage, said seat members having recesses therein for receiving and retaining said spring to transmit the force of said spring to each of said bars.
5. A combination according to claim 4, in which each of said seat members is in the form of a lug formed integrally with one of said bars and projecting therefrom toward said carriage.
6. In an electrical switch, the combination comprising a casing, an insulating carriage movable in said casing, means for moving said carriage, an insulating member mounted on said casing opposite one side of said carriage, a plurality of contacts mounted on said insulating member, a conductive contactor mounted on said carriage and movable into engagement with said contacts, and spring means connected between said carriage and said contactor for biasing said contactor against said contacts, said contactor having a pair of guide portions bent substantially at right angles thereto and extending toward said carriage, said carriage having a pair of guide slots for receiving said guide portions, said contactor comprising a plurality of bar members with slot means therebetween, said bar members extending between said guide portions, said slot means extending entirely through one of said guide portions, said contactor comprising a flexible web portion formed integrally with the other guide portion and extending between said bar members as the sole connection therebetween whereby said bar members are resiliently rockable relative to each other to afford firm engagement between said bar members and said contacts.
7. A combination according to claim 6, in which said slot means extends through a portion of said other guide portion whereby the width of said web portion is substantially less than the length of said guide portion.
8. A combination according to claim 6, in which said contactor is formed with lateral slots extending from one end of said slot means adjacent said web portion and thereby increasing the torsional flexibility of said web portion.
9. In an electrical switch, the combination comprising a casing, an insulating carriage movable in said casing, means for moving said carriage, an insulating member mounted on said casing opposite one side of said carriage,

a plurality of contacts mounted on said insulating member,
 a conductive contactor mounted on said carriage and movable into engagement with said contacts, said contactor having a pair of guide lugs bent therefrom toward said contactor, 5
 said contactor having a pair of guide slots for receiving said guide lugs,
 said contactor comprising a plurality of bars with a longitudinal slot therebetween, 10
 said bars extending between said guide lugs,
 said longitudinal slot extending entirely through one of said guide lugs,
 said contactor comprising a flexible web portion formed integrally with the other guide lug and extending between said bars whereby said bars are relatively rockable, 15
 said contactor having lateral slots extending along said other guide lug from one end of said longitudinal slot to increase the effective length and torsional flexibility of said web portion, 20
 and a single coil spring compressed between said carriage and said bars of said contactor for biasing said bars against said contacts,
 each of said bars having a spring seat tab formed integrally therewith and projecting therefrom toward said carriage, 25
 said tab having a recess therein for receiving and locating the end coil of said spring to transmit the force of said spring to said bars. 30

10. In an electrical switch,
 the combination comprising a casing,
 a carriage movable in said casing,
 a contactor mounted on said carriage,
 a plurality of contacts mounted on said casing and engageable by said carriage, 35
 a bushing projecting from said casing opposite said carriage and having an opening therein,
 an operating lever extending through said opening in said bushing and having an inner end engaging said carriage, 40
 said lever having a ball-pivot portion,
 said bushing having an annular seat therein engageable by said ball-pivot portion,
 and a coil spring compressed within said bushing, 45
 said coil spring being mounted around said lever and with one end of said spring against said ball-pivot portion for biasing said ball-pivot portion against said seat to retain said lever in said bushing against displacement and rattling movement, said casing having a shoulder supporting the opposite end of said coil spring. 50

11. A combination according to claim 10, in which said coil spring is cone-shaped with the small

end engaging said ball-pivot portion of said lever, said shoulder on said casing supporting the larger end of said coil spring.

12. A combination according to claim 4, in which said bars are formed with stiffening members opposite said seat members.

13. A combination according to claim 4, in which each of said bars is formed with an integral embossed stiffening member opposite said seat members.

14. A combination according to claim 4, in which each of said bars is formed with an integral reinforcing flange angling therefrom opposite said seat members.

15. A combination according to claim 4, in which each of said members comprises a lug struck from the corresponding bar, and in which each bar is formed with a stiffening member opposite said lug.

16. A combination according to claim 4, in which said seat members are in the form of lugs struck from said bars, and in which said bars are formed with integral embossed stiffening ribs opposite said lugs.

17. A combination according to claim 4, in which said seat members are in the form of lugs struck from said bars, and in which said bars are formed with stiffening flanges angling therefrom opposite said lugs.

18. A combination according to claim 1, in which said carriage is formed with recesses opposite said seat members for receiving said seat members.

19. A combination according to claim 1, comprising interengageable detent members on said casing and said carriage on the opposite side thereof from said coil spring, said spring being effective to bias said detent members into engagement.

20. A combination according to claim 19, in which said carriage is formed with recesses opposite said seat members for receiving said seat members during detenting movement of said carriage.

References Cited by the Examiner

UNITED STATES PATENTS

3,206,562	9/1965	Griggs et al.	200—6
3,223,794	12/1965	Hoy et al.	200—16
3,235,679	2/1966	Schaad et al.	200—16

ROBERT K. SCHAEFER, *Primary Examiner.*

J. R. SCOTT, *Assistant Examiner.*