June 15, 1965 W. N. SCHINK 3,188,697

LEVER ACTION SWITCH WITH EMBEDDED COMPRESSION COIL SPRING AND STAGGERED CONTACT MEANS

Filed Aug. 5, 1963

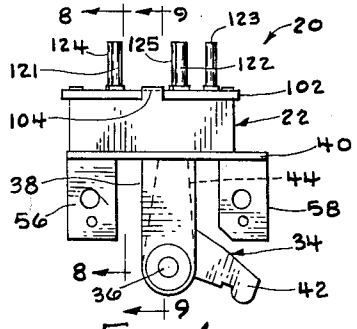


FIG. 1

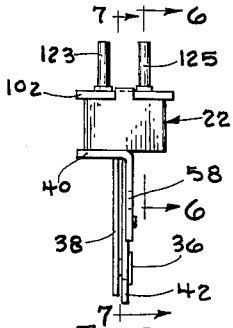


FIG. 2

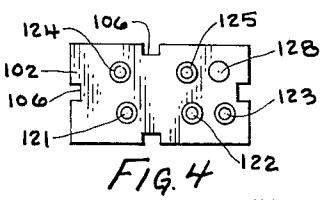


FIG. 4

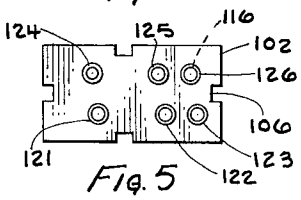


FIG. 5

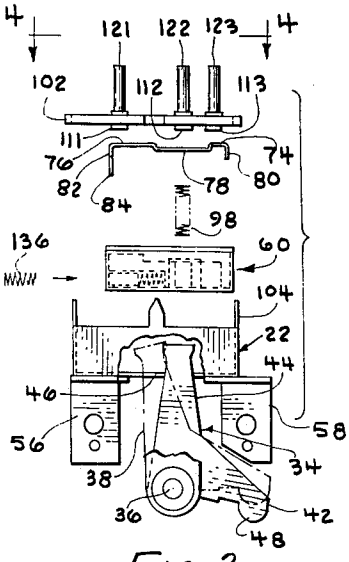


FIG. 3

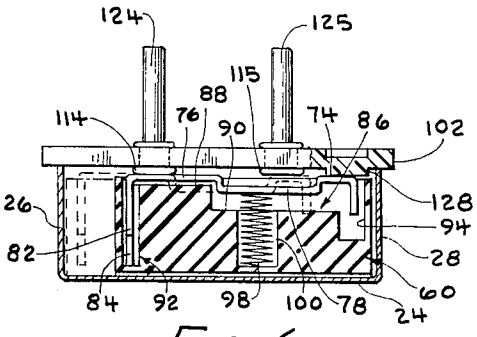


FIG. 6

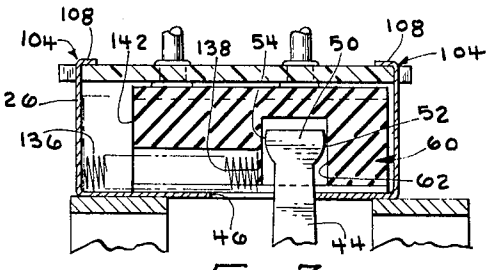


FIG. 7

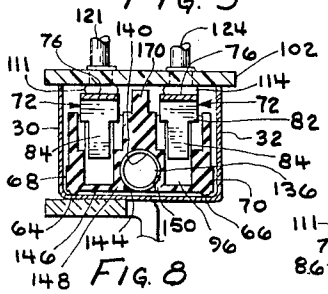


FIG. 8

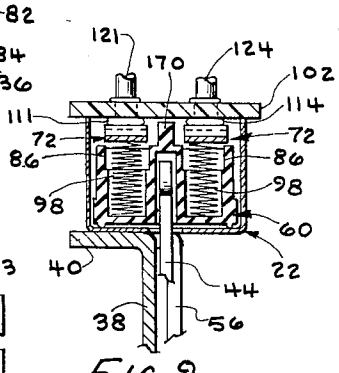


FIG. 9

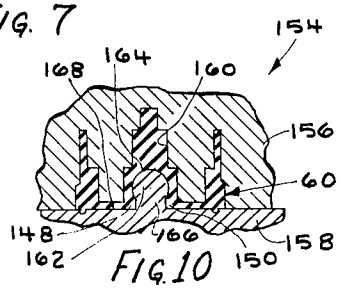


FIG. 10

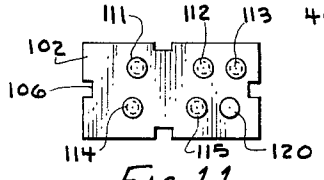


FIG. 11

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LEVER ACTION SWITCH WITH EMBEDDED COMPRESSION COIL SPRING AND STAGGERED CONTACT MEANS

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10 Claims. (Cl. 200—16)

This invention relates to electrical switches for making and breaking electrical circuits.

One object of the present invention is to provide a new and improved lever action switch having an operating lever which is swung back and forth to change the position of the switch.

A further object is to provide a new and improved lever action switch having one or more switch contactors which are movable linearly in response to the swinging movement of the operating lever.

Another object is to provide a new and improved switch of the foregoing character in which the contactors are mounted on a linearly movable slider made of insulating material.

A further object is to provide such a new and improved switch in which the slider may optionally be provided with a return spring for biasing the slider to one position.

Another object is to provide a new and improved method of forming a seat or recess in the slider for the return spring.

A further object is to provide a new and improved switch of the foregoing character in which the contactors and the contacts engageable by the contactors may readily be arranged in a variety of combinations to provide a switch which is double-pole double-throw, double-pole single-throw, single-pole double-throw, or single-pole single-throw, for example.

Another object is to provide a contact mounting plate which is made of insulating material and is provided with semi-perforations to replace any contacts which are not needed for any particular mode of switch operation.

Another object is to provide a new and improved switch in which the contacts are staggered so that the engagement of the contactors with the contacts will be extremely smooth. In this way, any false detenting action is avoided.

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

FIGS. 1 and 2 are front and side elevational views, respectively, of a lever action switch to be described as an illustrative embodiment of the present invention.

FIG. 3 is an exploded or disassembled view of the switch of FIGS. 1 and 2.

FIG. 4 is a plan view of the contact plate, taken generally as indicated by the line 4—4 in FIG. 3.

FIG. 5 is a view similar to FIG. 4, but showing a modified construction.

FIGS. 6 and 7 are longitudinal sections, taken generally along the lines 6—6 and 7—7 in FIG. 2.

FIGS. 8 and 9 are cross-sectional views, taken generally along the lines 8—8 and 9—9 in FIG. 1.

FIG. 10 is a fragmentary cross-sectional view showing the method of molding the spring seat in the slider.

FIG. 11 is a bottom view of the contacts and contact supporting plate.

It will be seen that the drawings illustrate an electrical switch 20 having a casing 22 which is preferably made of metal but may be made of plastics or other suitable materials. The illustrated casing 22 is in the form of a generally rectangular shell having a bottom wall 24, end walls 26 and 28, and side walls 30 and 32.

The illustrated switch 20 has a generally L-shaped

operating lever 34 which is swingable about a rivet or other suitable pivot 36, mounted on a bracket 38. The illustrated bracket 38 has a horizontal flange 40 which is riveted or otherwise secured to the bottom wall 24 of the casing 22. The bracket 38 projects downwardly from the casing 22.

The illustrated lever 34 has a first arm 42 which extends laterally from the pivot 36, and a second arm 44 extending upwardly from the pivot 36 and projecting into the casing 22 through a slot 46 in the bottom wall 24 thereof. As shown, the arm 42 is formed with a rounded nose or finger 48 adapted to be engaged by a cam or other operating means, not shown. It will be seen that the upwardly projecting arm 44 has an enlarged upper portion 50 formed with rounded edges 52 and 54 on both sides.

Mounting brackets 56 and 58 may also be provided on the casing 22. In this case, the mounting brackets 56 and 58 are formed integrally with the lever supporting bracket 38. The mounting brackets 56 and 58 take the form of arms projecting downwardly from the horizontal flange 40.

The upwardly projecting arm 44 is adapted to operate a slider 60 which is received within the casing 22. Preferably, the slider 60 is made of a suitable plastic insulating material. A slot 62 is formed in the slider 60 to receive the enlarged upper end portion 50 of the arm 44. The rounded edges 52 and 54 of the upper end portion 50 are adapted to engage opposite sides of the slot 62.

The illustrated slider 60 is generally rectangular in shape and is adapted to slide along the inside of the bottom wall 24 of the casing. Downwardly projecting ribs or runners 64 and 66 are formed on the bottom of the slider 60 to engage the bottom wall of the casing 22. The runners 64 and 66 extend longitudinally along the slider 60 and are adapted to slide along the bottom wall 24. The illustrated slider 60 also has ribs or runners 68 and 70 which project from the sides of the slider and are adapted to slide along the side walls 30 and 32 of the casing 22. The runners 68 and 70 extend longitudinally along the slider 60.

The illustrated slider 60 is adapted to carry either one or two contactors 72, two such contactors beeing illustrated. The contactors 72 are mounted on the upper side of the slider 60. The contactors 72 are electrically conductive and are normally made of metal. It will be seen that each contactor 72 comprises a relatively short horizontal contacting portion 74, a relatively long horizontal contacting portion 76, and a horizontal interconnecting portion 78 exteding between the portions 74 and 76. The portions 74, 76 and 78 are generally in the form of bars or strips. The interconnecting portion 78 is offset downwardly from the contacting portions 74 and 76, which are at substantially the same horizontal level. As shown, flanges or legs 80 and 82 project downwardly from the contacting portions 74 and 76. The flange 80 is shorter than the flange 82, as illustrated. It will be seen that the flange or leg 82 has a reduced lower end portion 84.

It will be understood that each contactor 72 may be formed in one piece from a metal bar or strip. The elements 74, 76, 78, 80 and 82 may be bent from such strip.

It will be seen that the slider 60 is formed with recesses 86 for receiving the contactors 72. The recesses 86 are generally in the form of longitudinal grooves extending along the upper side of the slider 60. Each recess 86 has a shallower portion 88, for receiving the longer contacting portion 76, and a deeper portion 90, for receiving the interconnecting portion 78 and the contacting portion 74. As shown to advantage in FIG. 6, a deep narrow slot 92 is formed at the left-hand end of each recess 86, for receiving the longer flange 82. A

shallower and wider slot 94 is formed at the opposite end of the recess 86 for receiving the shorter flange 80. Each slot 92 has a reduced lower portion 96 for receiving the reduced end portion 84 of the corresponding flange 82.

In the illustrated construction, each contactor 72 is biased upwardly by a coil spring 98 which is compressed between the intermediate portion 78 of the contactor and the slider 60. A well or socket 100 is preferably formed in the slider 60 to receive each spring 98. It will be seen that each socket 100 is formed in the deeper portion 90 of the corresponding recess 86.

The contactors 72 are adapted to engage a plurality of contacts which are mounted on a contact supporting plate 102 made of insulating material. In the illustrated construction, the plate 102 is secured to the casing 22 by means of a plurality of ears 104 formed on the casing. The ears extend through slots or notches 106 formed in the edges of the contact plate 102. It will be seen that the ears 104 are bent over above the contact plate 102 to form retaining flanges 108.

The arrangement of FIGS. 4 and 11 employs five contacts 111, 112, 113, 114 and 115, while the modified arrangement of FIG. 5 employs a sixth contact 116. As shown, the contacts 111–115 are riveted through the contact plate 102 and are connected to terminal pins 121–125. In the arrangement of FIG. 5, a sixth terminal 126 is employed.

In the arrangements of FIGS. 4 and 11, the sixth contact 116 is replaced by an insulating the boss 128 which projects downwardly from the insulating plate 102. The boss 128 is preferably in the form of a semiperforation, partially punched or extruded from the plate 102. In shape and size, the insulating boss 128 is similar to the contacts 111–115. It will be seen that the contacts also project downwardly from the insulating plate 102. If any contact is not needed in a particular switching operation, the contact may be replaced with an insulating boss or semiperforation.

It will be apparent that the longer contacting portion 76 of one of the contactors 72 is slidable along the contact 111 and is maintained in engagement with such contact at all times. The shorter contacting portion 74 of the same contactor 72 is slidable between the contact 113 and the contact 112. Thus, this contactor 72 and the three contacts 111, 112 and 113 act as a single pole, double throw switch.

In the case of the other contactor 72, the longer contacting portion or segment 76 slides along and engages the contact 114 at all times. The shorter contacting portion or segment 74 is slidable between the insulating boss or semiperforation 128 and the contactor 115. Thus, these elements of the device act as a single pole, single throw switch, or as a simple single pole on-off switch. In the modified arrangement of FIG. 5, the shorter contact segment 74 is slidable between the contacts 116 and 115, so that the contactor 72 and the contacts 114, 115 and 116 act as a single pole, double throw switch. When both contactors are considered, the switch is of the double pole, double throw type.

If only the contacts 114 and 115 are used, a single pole, single throw switch is provided, as already indicated. If only the contacts 111, 112 and 113 are used, a single pole, double throw switch is provided. A double pole, single throw switch may be provided by using only the contacts 111, 112, 114 and 115. A double pole, double throw switch is provided if all six contacts 111–116 are used, as in the arrangement of FIG. 5.

While pin-type terminals 121–126 are illustrated, any other conventional or suitable type of terminal may be employed.

To smooth the operation of the switch so as to avoid any false detent feel, the contacts are preferably staggered, as illustrated, so that the two contactors 72 do not make and break at the same time. Thus, from FIG. 11, it will be noted that the contacts 112 and 113 are staggered to the right relative to the contact 115 and the semiperforation or boss 128. In the arrangement of FIG. 5, the contact 113 is staggered relative to the contact 116. Thus, the first contactor 72, which engages the contacts 111, 112 and 113, operates slightly ahead of the second contactor, which engages the contacts 114, 115 and 116. The smaller contact segment 74 of the first contactor 72 engages the contact 112 before the small contact segment of the second contactor engages the contact 115. The break action between the first contactor and the contact 113 occurs before the break between the second contactor and the contact 116. On the reverse movement of the switch slider 60, the second contactor breaks with the contact 115 before the first contactor breaks with the contact 112. Moreover, the second contactor makes with the contact 116 before the first contactor makes with the contact 113. In addition, for smooth operation, the switch is preferably of the make before break type. Thus, the small contacting segment 74 of the first contactor 72 preferably makes with the contact 112 before it breaks with the contact 113. Similarly, the second contactor preferably makes with the contact 115 before it breaks with the contact 116. In the arrangement of FIGS. 4 and 11, the semiperforation or insulating boss 128 takes the place of the contact 116.

The switch 20 may be provided with a return spring 136 which biases the slider 60 to one of its two positions. In this case, the spring 136 biases the slider 60 toward its right-hand position, as shown in FIGS. 6 and 7. In this position, one of the contactors 72 engages the contacts 111 and 113, while the other contactor engages the contact 114 and the insulating semiperforation 128. As shown, the spring 136 is in the form of a coil spring compressed between the slider 60 and the end wall 26 of the casing 22.

A seat or recess 138 is preferably formed in the slider 60 to receive the coil spring 136. The seat 138 establishes and maintains the position of the spring 136 and prevents lateral movement of the spring. When the spring 136 is compressed, it tends to shift laterally, but such movement is prevented by the spring seat 138. Thus, the recess 138 makes it possible to use a long coil spring which is compressed initially to a considerable extent.

As shown, the spring seat or recess 138 has a circular or cylindrical portion 140 which extends into the left-hand end surface 142 of the slider 60. The cylindrical portion 150 extends to a considerable depth to provide for the length of the spring 136. The lower side portion of the cylindrical opening 140 opens downwardly into a slot portion 144 which extends along the bottom surface 146 of the slider 60. However, the slot 144 is smaller in width than the diameter of the coil spring 136, so that the coil spring 136 will not pass laterally through the slot 144. The diameter of the coil spring 136 is only slightly less than the diameter of the cylindrical portion 140 of the spring seat 138. It will be seen that the cylindrical portion 140 has a periphery which extends through approximately three-quarters of a complete circle, and in any event considerably more than a semicircle. It will be seen that the slot 144 has opposed edge portions 148 and 150 which retain the coil spring 136 in the seat 138. The spring seat or recess 138 gives the effect of a cylindrical bore extending into the end surface 142, although the lower portion of the spring seat opens downwardly through the slot 144.

By virtue of the provision of the return spring 136, the switch 20 may be operated simply by pushing on the rounded nose portion 48 of the arm 42. The push causes the lever 34 to swing in a counterclockwise direction, so as to move the slider 60 to the left. When the push is released, the slider 60 returns to the right.

The slider 60 may be molded from any suitable plastic

material by using a simple two-piece mold **154**, as shown in FIG. 10, without any need to provide a side core to form the spring seat **138**. As shown, the mold **154** comprises two parts **156** and **158**. A cavity **160**, corresponding in shape to the slider **60**, is formed in the molds **156** and **158**, the larger portion of the cavity being in the mold **156**. The spring seat **138** is formed by a rib or spine **162** on the mold **158**. It will be seen that the rib **162** has a cylindrical portion **164** which is solidly connected to the mold **158** by a web portion **166**. The cylindrical rib **162** corresponds in shape to the cylindrical portion **140** of the spring seat **138**. The web portion **166** is effective to form the slot **144**. It will be seen that the web portion **166** connects with a flat surface **168** on the mold **158**. The flat surface **168** is effective to form the bottom surface **146** of the slider **60**.

It will be noted that there is interference or an interlocking action between the cylindrical rib **164** of the mold **158** and the edges or lips **148** and **150**. Such interference complicates the extraction of the molded slider **160** from the mold **158**. However, it has been found that the slider **60** can be separated from the mold **158** by exerting a sufficient force therebetween. Such force causes springing or flexing of the slider **60** so that the lips **148** and **150** spring past the cylindrical rib **164**. The plastic material of the slider **60** is sufficiently flexible and resilient to permit the slider to spring past the cylindrical rib **164**.

This method of holding the slider brings about a considerable reduction in the cost of the slider. Moreover, an increase is effected in the rate at which the slider is produced. The lips **148** and **150** afford adequate retention of the coil spring **136**, while making it easy to mold the slider **60**.

It will be seen that the slider **60** has an upwardly projecting central fin or wall **170** which is situated between the contactors **72**. The wall **170** extends to a point just below the insulating plate **102**. Normally, the wall or fin **170** does not engage the plate **102**, because the contactor springs **98** push the slider **60** downwardly, while pushing the contactors **72** upwardly against the contacts **111–116**. However, the wall **170** prevents any substantial longitudinal rocking movement of the slider **60** and insures that the slider will be maintained in its proper position within the casing **22**.

It will be recognized that the switch is effective and versatile in operation, yet is low in cost and easy to manufacture.

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.

I claim:

1. In an electrical switch,
the combination comprising a generally rectangular casing,
a generally rectangular slider in said casing, said slider being made of insulating material and being slidable longitudinally in said casing,
a bracket mounted on said casing,
an L-shaped lever pivotally mounted on said bracket,
said casing having a slot therein,
said lever having an arm extending into said casing through said slot,
said slider having a recess receiving said arm,
a coil spring compressed between one end of said casing and one end of said slider,
said slider having a generally circular seat in said one end thereof for receiving said spring,
said seat having an opening in one side thereof toward one side of said slider,
a contactor bar mounted on said slider,
a contact mounting plate attached to said casing and opposite said contact bar,
a plurality of contatcs mounted on said contact mounting plate and engageable by said contactor bar,

said slider having recess means for receiving said contactor bar,
and a coil spring compressed between said slider and said contactor bar and biasing said contactor bar toward said contacts,
said contactor bar having first and second longitudinally spaced contactor segments with an intermediate portion therebetween,
said intermediate portion being offset from said contactor segments away from said contacts,
said first contactor segment being longer than said second segment,
said contacts including a first contact which is slidably engaged by said first contactor segment at all times,
said contacts including second and third contacts engageable by said second contactor segment,
said second contactor segment being movable between said second and third contacts.

2. In an electrical switch,
the combination comprising a casing,
a slider in said casing, said slider being made of insulating material and being slidable linearly in said casing,
a contactor bar mounted on said slider and extending generally in the direction of movement thereof,
said contactor bar having first and second contactor segments spaced longitudinally therealong with an intermediate portion between said segments,
a contact supporting member attached to said casing,
said intermediate portion being offset away from said member relative to said segments,
said first segment being longer than said second segment,
a first contact on said member and slidably engageable by said first contactor segment at all times,
said slider being movable between first and second positions in said casing,
a second contact on said contact supporting member and slidably engageable by said second contactor segment when said slider is in said first position,
and a contact-shaped projection on said contact supporting member and slidably engageable by said second contactor segment when said slider is in said second position.

3. The combination of claim **2**,
in which said projection comprises a third contact mounted on said contact supporting member.

4. The combination of claim **2**,
in which said projection comprises an insulating boss formed on said contact supporting member,
said insulating boss being at the same level as said contacts.

5. The combination of claim **2**,
in which said projection comprises an insulating semiperforation formed from said contact supporting member and at substantially the same level as said contacts.

6. In an electrical switch,
the combination comprising a casing,
a slider in said casing, said slider being movable linearly in said casing between first and second positions,
a pair of parallel contactor bars mounted on said slider,
a contact supporting member attached to said casing and opposite said contactor bars,
a pair of parallel rows of contacts on said contact supporting member and engageable by the corresponding contactor bars,
each of said contactor bars having first and second contactor segments with an intermediate portion therebetween offset from said segments away from said contacts, said first and second contactor bars being alike and being mounted directly opposite each other on said slider,
each row of said contacts comprising a first contact engageable by said first contactor segment corresponding to said row,

and at least a second contact engageable by said second contactor segment corresponding to said row,

said second contacts in said rows being staggered with respect to each other whereby said second contactor segments engage said second contacts sequentially to smoothen the operation of said switch and avoid false detenting action.

7. The combination of claim 6,

in which each of said rows of contacts includes a third contact engageable by said second contactor segment,

said third contacts also being staggered with respect to each other whereby said second contactor segments engage said third contacts sequentially.

8. The combination of claim 6,

in which one of said rows of contacts comprises a third contact engageable by said second contactor segment,

the other row of contacts having an insulating boss aligned therewith on said contact supporting member,

said insulating boss being staggered with respect to said third contact whereby said second contactor segments engage said third contact and said boss sequentially.

9. The combination of claim 6,

in which each of said rows of contacts has an additional contact-shaped projection aligned with each of said rows on said contact supporting member,

said second contactor segments being engageable with said additional projections,

said additional projections being staggered with respect to each other whereby said projections are engaged sequentially by said second contactor segments.

10. In an electrical switch,

the combination comprising a casing,

a slider in said casing,

said slider being made of insulating material and being slidable in said casing,

and a compression coil spring in said casing and compressed between said casing and one side of said slider for biasing said slider in one direction,

said slider having a recess therein receiving one end portion of said spring,

said recess being generally cylindrical in shape and generally circular in cross section but having an open longitudinal slot portion extending along the length of said recess and opening to the outside of said slider,

the width of said slot portion being less than the diameter of said spring whereby said spring is retained in said recess.

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