

June 23, 1970

D. R. GAINES ET AL

3,517,141

LIMIT SWITCH

Filed Nov. 13, 1967

3 Sheets-Sheet 1

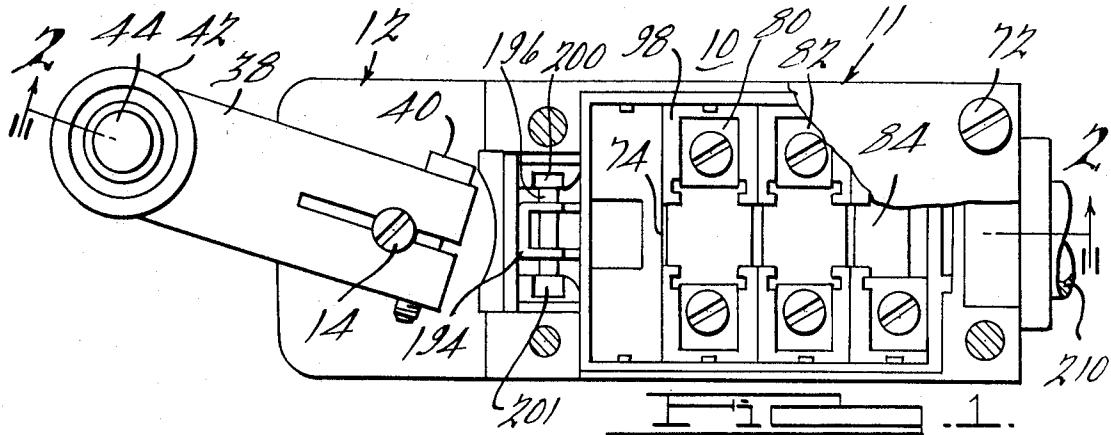
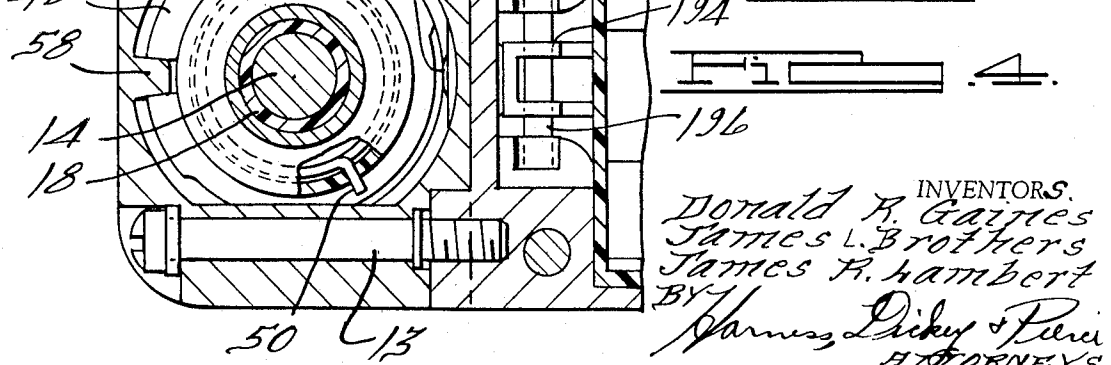
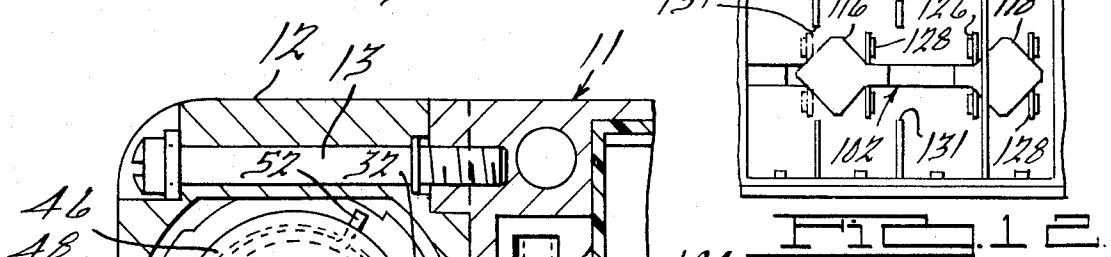
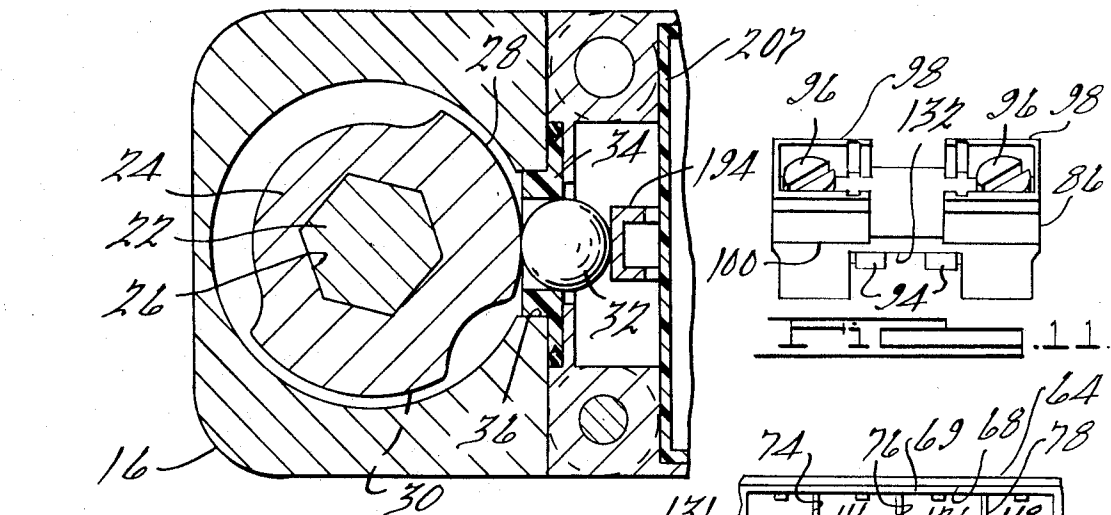


FIG. 3.



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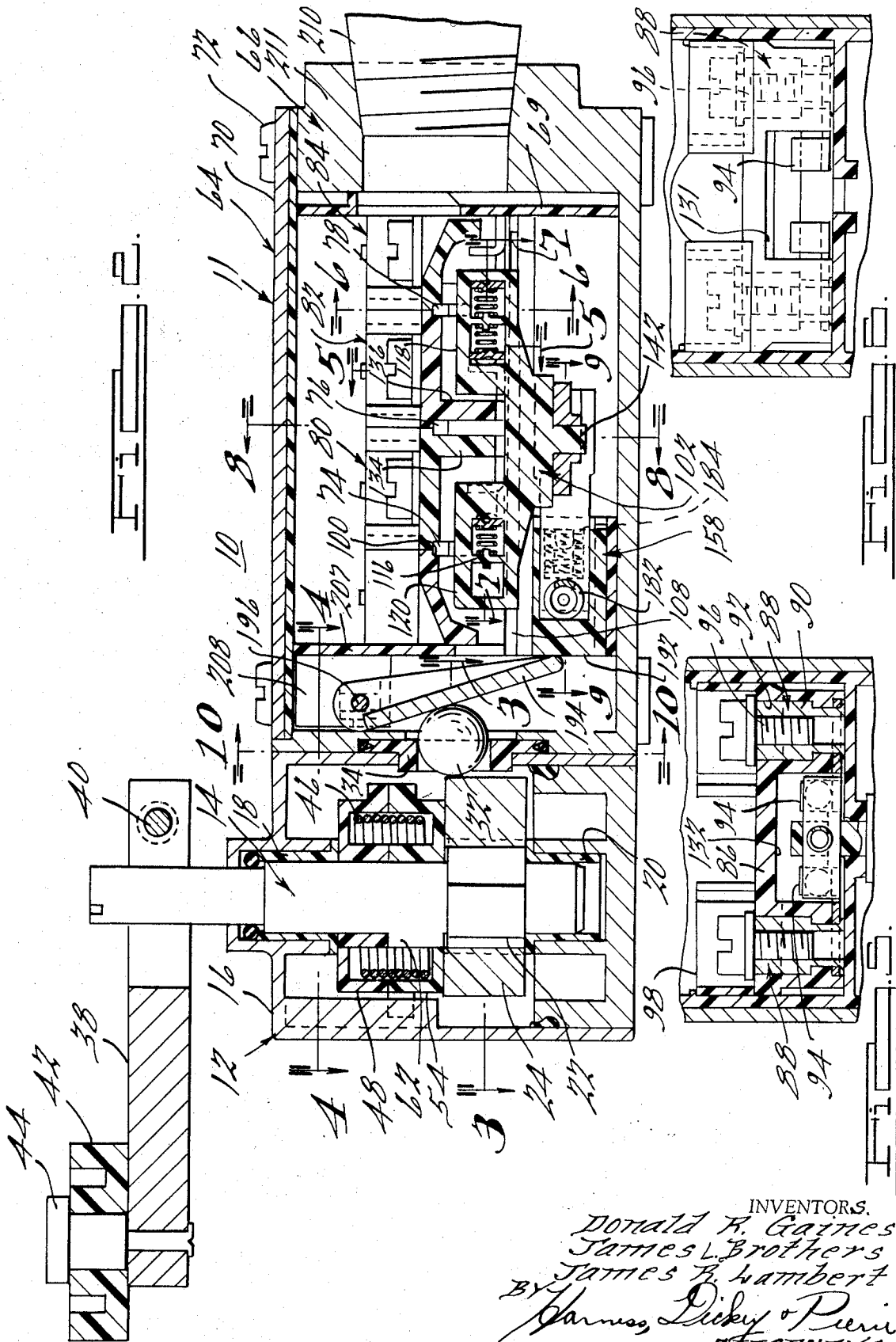
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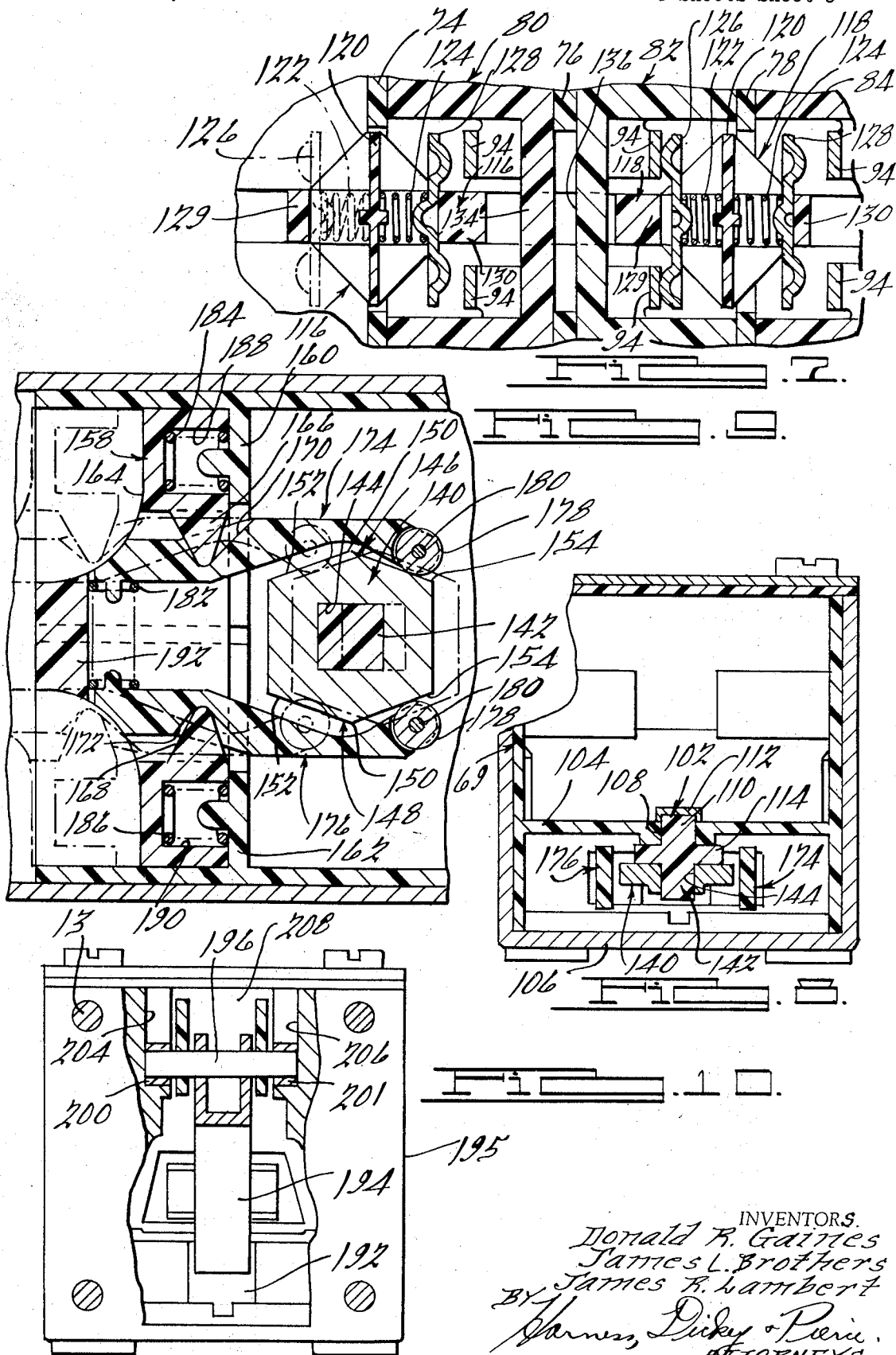
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LIMIT SWITCH

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3,517,141

LIMIT SWITCH

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U.S. Cl. 200—16

8 Claims

ABSTRACT OF THE DISCLOSURE

This invention is an electrical make-and-break switch which is uniquely constructed so that a maximum number of the switch components can be made of plastic material by conventional injection molding methods. It is a feature of the invention that the switch housing is divided into a plurality of compartments that accommodate removable modules having fixed contacts which cooperate with bridging contact members carried by a movable switch element also mounted in the housing. In practice, the housing can be fitted with one or more of these modules depending on the intended use of the switch. The fixed contacts on certain modules are positioned so as to be normally closed by the bridging contact members and the fixed contacts of other modules are differently positioned so as to be normally open. At least certain of the modules fit interchangeably in more than one compartment of the housing and the normal condition of the contacts can be changed by moving the modules from one compartment to another. In this manner, maximum versatility in the number of possible circuit arrangements is achieved with a minimum number of parts. Thus, simply by using selected numbers of standard module components differently arranged in the housing it is possible to have one or several normally open contacts, one or several normally closed contacts, or different combinations of normally open or normally closed contacts.

This invention relates to an electrical switch means and more particularly to a limit switch arrangement which has great flexibility and adaptability for performing a multiplicity of different switching functions.

As a special feature of the invention, the movable switch element carries spring-loaded, pivoted arms that coact with stationary V-shaped cams provided in the housing; and the arms act against the cams to urge the bridging contacts against the fixed contacts with increasing pressure during initial sliding movement of the switch element to reverse the contact condition and then, as the arms pass over the apices of the cams, separate the bridging contacts from the fixed contacts with a snap action thus minimizing damage to the contacts in use.

It is to be understood that this abstract is intended to serve merely as a brief description or summary of the invention. It does not necessarily define all of the features of the invention and it is not intended that it in any way limit the scope of the appended claims.

It is a feature of the invention to provide an electrical switching means, particularly useful as a limit switch, in which a plurality of modules having different arrangements of fixed contacts are removably mounted in a housing member. These fixed contacts cooperate with a movable switch member having a plurality of bridging contact bars, each of which is adapted to engage or be disengaged from the fixed contacts carried by the modules depending on the way the modules are positioned within the housing. The fixed contacts may be normally open or normally closed by the bridging contact bars. Thus, with

a plurality of different modules inserted within the housing, a combination of normally open or normally closed contacts may be obtained.

The housing member is adaptable also for use with one or more of these modules that are received in compartments in the housing, and as a result one or a number of modules and different switching functions may be provided. The movable switch member moreover is suitable and adaptable to the module concept, since it includes means whereby a number of bridging contact bars may be positioned thereon commensurate with the number of modules or fixed contacts positioned in the housing.

It is also a feature of the invention to provide transverse webs on the undersides of two of the module members that are adapted to be engaged by stop means positioned on the movable switch member. Thus, the cooperating transverse webs and the stop means on the movable switch member limit movement of the movable switch member in both directions.

Still another feature of the invention is the provision of a means on the movable switch member that cooperate with a movable actuating plunger to snap the movable switch member back and forth in the housing to engage and disengage the contact bars carried by the movable switch member with and from the fixed contacts carried by the modules positioned in the switch housing. This actuating plunger preferably has two pivoted arms with rollers on the end thereof that are urged inwardly to embrace surfaces on a cam formed on the movable switch member. The cam can be described also as a pair of oppositely extending V-shaped cams having apices that are outboard of the movable switch member. The rollers on the ends of the two pivoted arms are normally positioned on surfaces at one side of the apices of the cam edges and when so positioned they hold the movable switch member at one end of its travel.

As the actuating plunger is moved by the actuating means, the rollers ride over the apices of the cams and as soon as they move onto the opposite cam edges, they snap the movable switch member to the other end of its travel and thus make or break an engagement between the bridging contact bars mounted on the movable switch member and the fixed contacts carried by the modules. This arrangement, with the two pivoted arms and oppositely disposed rollers engaging the surfaces of the cam, maintains equal pressure on the cam, thus equalizing the pressure on opposite sides of the movable switch member thereby avoiding any binding of the movable switch member in the switch housing. In addition, this arrangement provides a positive snap action of the movable switch member and also provides maximum contact pressure at snapover.

The actuating plunger and the two arms pivotally mounted thereon, preferably are constructed of plastic and the arms rock on wedge-shaped mountings formed on the actuating plunger. The construction of the movable actuating plunger and the pivotable arms of a plastic material provides many advantages and it is ideal from the standpoint of minimizing wear and costs. Furthermore, this arrangement is simple and very easy to assemble. Moreover, the arms rock easily on the edges or ends of the wedges and as a consequence, very little wear occurs during the use of the switch.

An object of the present invention is the provision of an electrical switch that is flexible in operation and may be easily and readily adaptable to provide a multiplicity of different switching functions.

It is a further object of the invention to provide an electrical switch that employs a plurality of modules carrying fixed contacts that may be removed and reinserted in a switching housing with certain of the modules per-

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forming the function of limiting the movement of a movable switch member carrying cooperating contact bars in both directions of its movement.

It is still another object of the invention to provide a movable switching element having removable contact bar elements so that the number of these contact bars may be made to coincide with the number of modules and fixed contacts carried by the switch housing.

It is still another object of the invention to provide a positively acting actuating means that acts upon the movable switch member to readily snap it from one of its operative positions to the other of its operative positions.

Other objects and attendant advantages of the present invention may be more readily realized as the specification is considered in connection with the attached drawings in which:

FIG. 1 is a top plan view of the electrical switch of the present invention with a portion of the top cover removed;

FIG. 2 is a longitudinal sectional view taken along the lines 2—2 of FIG. 1;

FIG. 3 is a sectional view taken along the lines 3—3 of FIG. 2;

FIG. 4 is a sectional view taken along the lines 4—4 of FIG. 2;

FIG. 5 is a sectional view taken along the lines 5—5 of FIG. 2;

FIG. 6 is a partial sectional view taken along the lines 6—6 of FIG. 2;

FIG. 7 is a partial sectional view taken along the lines 7—7 of FIG. 2;

FIG. 8 is a partial sectional view taken along the lines 8—8 of FIG. 2;

FIG. 9 is a partial sectional view taken along the lines 9—9 of FIG. 2;

FIG. 10 is a sectional view partially in elevation taken along the lines 10—10 of FIG. 2;

FIG. 11 is a perspective view of a switch module of the present invention; and

FIG. 12 is a reduced plan view of a portion of the switch housing of the present invention similar to FIG. 1 in which the switch modules have been removed.

Referring now to the drawings in which like reference numerals designate like parts throughout the several views thereof, there is shown in FIGS. 1 and 2 the overall electrical switch 10 of the present invention that comprises a switching element 11 and an actuating element 12. The actuating element 12 may be attached to the switching element 11 by any suitable means, for example, by a plurality of bolts 13 as shown in FIG. 4.

Referring to FIGS. 1—4, the actuating element 12 comprises a rotatable shaft 14 rotatably mounted in a housing 16 by a plurality of radial and thrust bearings designated by the numerals 18 and 20. The shaft 14 has an enlarged hexagonal portion 22 that nonrotatably carries a cam 24 having a complementary internally formed hexagonal aperture 26 to receive the hexagonal portion 22 of the shaft. The cam 24 has a pair of lobes 28 and 30 which engage a ball 32 positioned in a cylindrical bearing 34 inserted in an aperture 36 in the housing 16.

An actuating arm 38 has one end thereof affixed to the shaft 14 by a suitable fastening means 40, and it carries at its other end an annular rotatable abutment member 42 that may be suitably mounted for rotation on a pin 44. The abutment member 42 is adapted to be positioned in the path of a movable machine element or other structure that comes into engagement with the abutment member when the switch 10 is to be actuated to perform its switching function. The movable machine element or other structure, such as, a workpiece, would move in a vertical path as the switch is viewed in FIG. 1.

When the abutment member 42 is engaged by a machine element or other structure, the actuating arm 38 may be rotated either clockwise or counterclockwise as this machine element or other structure moves in one

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direction or another, for example, either vertically upwardly or downwardly as viewed in FIG. 1. When the actuating element 12 is in unactuated state, the shaft 14 is in such a position that the ball 32 is positioned between the lobes 28 and 30 of the cam 24. In the drawings, the switch is shown in its actuated state so that the ball 32 is positioned further to the right as viewed in FIGS. 2 and 3 than it would be when it is nested in the space between the lobes 28 and 30.

A return spring 46 is positioned around the shaft and has one end thereof affixed to a plastic cup member 48 by means of a tank 50 protruding into a slot in this cup member. The other end of the return spring 46 is secured through a tang 52 in an opening or groove in another inverted plastic cup-sized housing 54 that abuts the cup-shaped housing 48 and provides an enclosure for the spring 46. Means are provided, such as, an inwardly extending abutment 58 on the housing 16, to limit the rotatable movement of the cup-shaped housing 48 while a radially extending protrusion 62 on the shaft 14 extends into a slot in the inner wall of the inverted or lower cup-shaped housing 54 to limit its movement with respect to the shaft 14. The connections between shaft 14 and the lower cup-shaped housing 54 and between the upper cup-shaped housing 48 and the housing 16 may each have a certain amount of lost motion to prevent any damage to the spring 46 and to provide an easily operated return mechanism.

The switching element 11 includes a housing 64 having a rectangular box-shaped opening 68 that receives a box-shaped plastic liner 69 (FIG. 12). A cover 70 (FIG. 2) may be provided to close this box-shaped opening 68 and may be suitably secured to the housing by a plurality of screws 72. The box-shaped plastic liner 69 is divided into a plurality of compartments by means of a plurality of transversely extending shallow walls 74, 76 and 78, as best seen in FIGS. 2, 7 and 12. The compartments so formed by the shallow transverse walls 74, 76 and 78 are each adapted to receive a switch module, and these switch modules can best be seen by reference to FIGS. 1, 2 and 7 where they carry the reference numerals 80, 82 and 84. An inspection of FIGS. 1, 2 and 7 will reveal that the compartment on the left, that is to the left of the shallow wall 74, does not, in these drawings, contain a module, but it may nevertheless receive one if another switching function other than those that can be formed by three modules 80, 82 and 84 is to be performed.

Each of the modules comprises a box-like plastic housing member 86 that is adapted to be press-fitted into any one of the compartments formed by the walls 74, 76 and 78, so that the modules may be readily inserted and removed from these compartments. Each module has a pair of fixed contact elements 88 fixed thereto, and, as shown in FIGS. 5 and 6, each of these fixed contact elements has a portion 90 which is square in transverse section positioned in an aperture 92 in the module. Each of the contact members 88 also has an inwardly extending contact 94 formed thereon so that the contacts 94 of the contact elements 88 in each module are positioned in spaced relationship in a plane generally transverse to the longitudinal axis of the switch. Each contact element 88 is internally threaded to receive a bolt or machine screw 96 for the purpose of attaching a lead thereto that may extend to and connect with a suitable external circuit.

As best shown in FIGS. 1, 2 and 11, the head of each machine screw 96 is enclosed by either an L-shaped or three-sided wall member 98. One side of this wall member has a transversely extending shoulder 100 that engages the upper edge of one of the transverse walls 74, 76 or 78 of the plastic liner member 69 when the modules 80, 82 or 88 are inserted into the compartments formed by walls 74, 76 and 78. This properly positions the modules in the plastic liner 69 so that the fixed contacts

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94 are positioned properly in the housing 64 and plastic liner 69 in a vertical direction as the switch is viewed in FIG. 2.

A movable switch member generally designed by the numeral 102 is slidably mounted for longitudinal movement in the housing 64. As can best be seen by reference to FIG. 8, the plastic liner 69 of the housing 64 has a horizontal floor or wall 104 positioned substantially above the bottom wall 106 of the housing. This horizontal wall 104 has a longitudinally extending slot 108 positioned therein for reception of a complementary upstanding bar 110 formed on the movable switch member 102. The movable switch member 102 has a head 112 positioned thereon that together with a transversely extending bar 114 properly secures the slidable switch member 102 to the horizontally extending bottom wall 104 to permit the switch member 102 to longitudinally slide in the longitudinally extending slot 108.

The movable switch member 102 also has integrally formed upstanding contact bar housings 116 and 118, each of which has a centrally located transverse wall 120 positioned thereon that carries opposed helical springs 122 and 124. As can best be seen by reference to FIG. 7, these springs are in engagement with contact bars 126 and 128 to urge them toward end walls 129 and 130 of the contact bar housings 116 and 118.

Each of the transversely extending walls 74, 76 and 78 of the plastic liner 69 have openings therein for the reception of the switch contact housings 116 and 118. A representative opening in the transversely extending wall 76 is designated by the numeral 131 in FIG. 6 and other openings are designated by the numeral 131 in FIG. 12. Similarly, the modules 80, 82 and 84 have suitable openings therein as represented by the numeral 132 in FIGS. 5 and 11 for the reception of the switch contact housings 116 and 118 and to permit these housings to reciprocate therein. It can be noted from FIG. 2 that the modules 80 and 82 that are in engagement with the central transverse wall 76 of the plastic liner 69 have depending walls 134 and 136, respectively, that extend into the path of the contact bar housings 116 and 118, respectively. These walls 134 and 136 provide stops for the switch member 102 as it is slidably moved by means to be described subsequently, either to the left or to the right, as shown in FIG. 2, with the wall 136 extending into the path of movement of the housing 118 as the movable switch element 102 is moved to the left in FIG. 2, and with the wall 134 extending into the path of movement of housing 116 as the movable switching member 102 is moved to the right in FIG. 2.

Referring now to FIGS. 8 and 9, the movable switching element 102 has a cam member generally designated by the numeral 140 affixed thereto by means of a depending rectangularly shaped pin 142 that depends from the bar 110 and is received within a complementary rectangular opening 144 in the cam member 140. This cam member is preferably of hexagonal form, as shown in FIG. 9, so that it has a first V-shaped cam 146 positioned on one side thereof and a second V-shaped cam 148 positioned on the other side thereof. Each V-shaped cam has an apex 150, a first surface 152 that extends outwardly from the longitudinal centerline of the switch to the apex 150 and a second surface 154 that extends from the apex 150 inwardly toward the longitudinal centerline of the switch.

An actuating plunger generally designated by the numeral 158 is slidably positioned within the plastic liner 69 that has a pair of inwardly extending walls 160 and 162. This actuating plunger has a main body portion 164 having a pair of inwardly extending wedges 166 and 168 integrally formed thereon for reception in complementary grooves 170 and 172 positioned in a first radially movable arm 174 and a second radially movable arm 176, respectively. Each of the radially movable arms 174 and 176 has a roller or cam follower means 178 suitably positioned thereon by means of a pin 180. The other ends of the

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radially extending arms 174 and 176 are biased outwardly in a transverse direction with respect to the centerline of the switch. This is accomplished by means of a helical spring 182 positioned on the inner surfaces of these ends of the radially extending arms 174 and 176. As a result, the rollers or cam follower means 178 positioned on the ends of the radially extending arms 174 and 176 are biased inwardly into engagement with the cam surfaces on the cam member 140.

The actuating plunger member 158 is urged or biased away from the walls 160 and 162 of the plastic liner 69 into the dotted line position shown in FIG. 9 when the switch is in the unactuated position by a pair of helical springs 184 and 186 positioned in cavities 188 and 190 of the actuating plunger member 158.

The end of the actuating plunger member 158 has a surface 192 positioned thereon for engagement with one end of an actuating lever 194 as can best be seen by reference to FIGS. 2, 9 and 10. The other end of the actuating lever 194 is pivotally mounted in an end wall 195 of the housing 64 by means of a pin 196 carried by a pair of rectangular shaped supports 200 and 201. These rectangular shaped supports are positioned in complementary shaped grooves 204 and 206 in the end wall 195. The housing 64 is provided with a depending wall 207 as can best be seen by reference to FIG. 2 that defines with the remainder of the housing 64 a chamber 208. This chamber 208 provides sufficient room for the actuating lever 194 to pivot about the pin 196.

As can best be seen by reference to FIGS. 2 and 3, the actuating ball 32 engages the central portion of the actuating lever 194 and as this ball moves in and out of the opening in the plastic bearing 34 under the impetus of the cam 24, the actuating lever 194 is pivoted about the pivot pin 196.

The switch of the present invention may be suitably mounted near its actuating means by a threaded arm 210 received in end wall 211 of the housing 64.

The operation of the switch of the present invention will now be described. The drawings show the switch in its actuated position. Assuming, however, that the switch is positioned in its unactuated position, the shaft 14 of the actuating element 12 will be rotated by the return spring 46 counterclockwise as shown in FIGS. 1 through 3 into the position where the actuating ball 32 is positioned between the lobes 28 and 30 of the cam member 24. This will permit the springs 184 and 186 of the actuating plunger member 158 to move it to the left, as shown in FIGS. 2 and 9, so that the ball 32 will be forced into position between lobes 28 and 30 of the cam 24 through the action of the actuating lever 194. When the switch is in the unactuated position, the actuating plunger member 158 will be in the dotted line position shown in FIG. 9.

This figure also shows the cam member 140 in a dotted line position when the switch is in the unactuated position. As can be seen by reference to this figure, the rollers 178 on the radial arms 174 and 176 will be positioned in engagement with the surfaces 152 of the V-shaped cams 146 and 148. The transverse or radial pressure exerted inwardly by these rollers 178 on the surfaces 152 urges the cam member 140 to the right and into the position shown by the dotted lines in FIG. 9.

When the switch is in this unactuated position, therefore, the movable switch member 102 will be positioned to the right from the position shown in FIG. 7 so that the contact bars 128 positioned in the modules 80 and 82 are in contact with the fixed contacts 94 positioned in these modules thereby providing normally closed contacts in these modules.

When a machine element or other structure on a mechanism adapted to operate the limit switch 12 engages the roller abutment 42 positioned on the actuating arm 38 as this machine element or other structure moves in a vertical and upward direction as viewed in FIG. 1, the actuating arm 38 will be rotated clockwise into the position shown in this figure.

The clockwise rotation of the actuating arm 38 will rotate the shaft 14 in a clockwise direction as viewed in FIGS. 3 and 4 thereby bringing the lobe 28 of the cam member 24 into engagement with the actuating ball 32 and forcing the actuating ball 32 through the opening in the plastic bearing member 34. This action swings the lever 194 into the position shown in FIG. 2 and the end of the lever opposite the pin 196 will force the actuating plunger member 158 to the right as shown in FIGS. 2 and 9. As previously pointed out, the rollers 178 are in engagement with the surfaces 152 on the V-shaped cams 146 and 148 (see the dotted line position of FIG. 9), and they will exert a pressure on the movable switch member 102 that tends to urge it to the right as viewed in FIGS. 2 and 7, thereby compressing the springs 124 positioned within the modules 80 and 84 and urging the contact bars 128 into firmer engagement with the fixed contacts 94 found in these two modules. The contact bar housing 116 may, at this time, engage the wall 134 of the module 80 that is shown in FIGS. 2 and 7, thereby providing a limit or a stop for the movement of the movable switch member 102 in this direction.

Further movement of the lever 194 and the actuating plunger member 158 to the right as shown in FIGS. 2 and 9 will force the rollers 178 of radial arms 174 and 176 outwardly until they move over the apices 150 of the two V-shaped cams 146 and 148. When this happens, the rollers 178 are in engagement with the surfaces 154 on these V-shaped cams and as a result of the inward pressure exerted by the rollers on these surfaces, the V-shaped cams and the movable switch member 102 are snapped to the left as viewed in FIGS. 2, 7 and 9 and into the position shown in these figures. This brings the contact bar members 128 positioned in the modules 80 and 84 out of engagement with the fixed contacts 94 positioned therein and brings the contact bar member 126 positioned in the module 82 into engagement with the fixed contacts 94 found in that module as shown in FIG. 7. This opens any circuits connected to the fixed contacts 94 found in modules 84 and 80 and closes a circuit that may be connected to the fixed contacts 94 found in the module 82.

When the machine element or other structure comes out of engagement with the abutment roller 42 on the radial arm 36 of the actuating element 12, the return spring 46 will rotate the shaft 14 in a counterclockwise direction hereby rotating the cam 24 in a counterclockwise direction so that the space between the lobes 28 and 30 is positioned opposite the actuating ball 32. The return springs 184 and 186 engaging the actuating plunger 158 move this actuating plunger to the left as shown in FIGS. 2 and 9, and the rollers 178 move outwardly and to the left as viewed in FIG. 9, over the surfaces 154 of the two V-shaped cams 146 and 148. This movement also moves the end of the lever 194 to the left as viewed in FIG. 2 and moves the actuating ball 32 into the space between the lobes 28 and 30 of the cam 24.

When the rollers 178 moves over the apices 150 of the two V-shaped cams 146 and 148 and into engagement with the surfaces 152, the movable switch member 102 is snapped to the right as viewed in FIGS. 2, 7 and 9. This returns the switch to the unactuated position, thereby positioning the contact bars 128 found in modules 80 and 84 in engagement with the fixed contacts 94 positioned therein and bringing the contact bar member 126 found in module 80 out of engagement with the fixed contacts 94 found in that module.

It is apparent from the description and the drawings that one or more modules may be positioned in the compartments of housing 69 of the switch element as shown in FIG. 12. As shown in FIG. 2, there are three of these modules that carry fixed contacts positioned within the housing. Another blank module that carries no fixed contacts may be positioned in the compartment to the left

of the module 80 to thereby lend support to the structure elements of the switch.

Referring now to FIG. 7, it can be seen that the number of contact bars designated by the numerals 126 and 128 may conveniently and easily be made to coincide with the number of modules carrying fixed contacts. This has been illustrated by the contact bar 126 and spring 122 shown in the dotted lines at the left edge of FIG. 7. Any one of the contact bars may be readily removed from the contact bar housings 116 and 118 by merely compressing the spring 122 or 124 and moving the elements outwardly in a transverse direction with respect to the longitudinal axis of the switch. Similarly, any of the contact bars 126 or 128 may be inserted in the contact bar housings 116 and 118 by the reverse procedure.

It should be noted that any combination up to two (2) normally open contacts and two (2) normally closed contacts may be provided by the insertion or the removal of the modules from the housing of the switch and by a suitable arrangement of fixed contacts in these modules.

Another important feature of the invention is the provision of downwardly extending walls 134 and 136 on the central two modules that are employed as limit or stop members for the movable switch member 102 carrying the contact switch bars 126 and 128.

Furthermore, the actuating plunger including the arms 174 and 176 with their radially inwardly urged end portions having the rollers positioned thereon in cooperation with the two V-shaped cams positioned on the movable switch member provides a snap-acting switch in which equal transverse forces are applied on the movable switch member that slides in switch housing thereby preventing cocking or binding of the movable switch element.

The construction of the actuating plunger including the radially movable arms that rock about the knife edges or the ends of the wedges 166 and 168 of a plastic material provides a structure in which very little wear occurs. Furthermore, the construction of this actuating plunger element and the arms of a plastic material is ideally suited for the purposes for which it is employed.

The switch of the present invention also has the advantage that nearly all of the operating parts may be constructed of a plastic material thereby lowering costs and providing the inherent advantages of this type of material.

While the forms of the invention described above constitute the preferred embodiment of the invention, it is to be understood that the invention is not limited to these precise forms and that changes may be made therein without departing from the scope of the invention, as defined in the appended claims.

What is claimed is:

1. An electrical switch having a housing, an opening in said housing divided into a plurality of compartments including means defining a cavity for forming a module receiving mounting having preselected characteristics, a plurality of movable conductive contact bars, a plurality of modules having a predetermined peripheral configuration in at least one plane which mates with said mounting characteristics, each of said modules having a movable switch member mounted in said housing and having a plurality of conductive contact bars removably mounted thereon and, fixed contacts matable with said conductive bars adapted to be connected to an external circuit to perform one of at least two switching functions, said modules fitting interchangeably into more than one of said compartments and certain of said modules having differently positioned fixed contacts from other of said modules to permit variation of said switching function from said one to another function.

2. An electrical switch having a housing, an opening in said housing divided into a plurality of compartments including means defining a cavity for forming a module receiving mounting having preselected characteristics, a

plurality of movable conductive contact bars, a plurality of modules having a predetermined peripheral configuration in at least one plane which mates with said mounting characteristics, each of said modules having a movable switch member mounted in said housing and having a plurality of conductive contact bars removably mounted thereon and, fixed contacts matable with said conductive bars adapted to be connected to an external circuit to perform one of at least two switching functions, said modules fitting interchangeably into more than one of said compartments and certain of said modules having differently positioned fixed contacts from other of said modules to permit variation of said switching function from said one to another function, said movable switch member having a longitudinal ridge, a first housing member and a second housing member, with each housing member carrying at least one of said conductive contact bars, and said housing having a longitudinal groove positioned therein receiving said longitudinal ridge.

3. An electrical switch having a housing, an opening in said housing divided into a plurality of compartments including means defining a cavity for forming a module receiving mounting having preselected characteristics, a plurality of movable conductive contact bars, a plurality of modules having a predetermined peripheral configuration in at least one plane which mates with said mounting characteristics, each of said modules having a movable switch member mounted in said housing and having a plurality of conductive contact bars removably mounted thereon and, fixed contacts matable with said conductive bars adapted to be connected to an external circuit to perform one of at least two switching functions, said modules fitting interchangeably into more than one of said compartments and certain of said modules having differently positioned fixed contacts from other of said modules to permit variation of said switching function from said one to another function, said movable switch member having a longitudinal ridge, a first housing member and a second housing member, with each housing member carrying at least one of said conductive contact bars, and said housing having a longitudinal groove positioned therein receiving said longitudinal ridge, each housing member including a transversely extending rib, a spring extending longitudinally of said movable switch member positioned between one side of said rib and said conductive contact bar, said spring resiliently biasing said conductive contact bar away from said rib, and a second conductive contact bar and second spring extending longitudinally of said movable switch member and positioned between the other side of said rib and said second conductive contact bar, said second rib resiliently biasing said second conductive contact bar away from said rib.

4. The combination of claim 1 in which said housing

is divided into said plurality of compartments by a plurality of transversely extending walls providing means for receiving said modules in a press-fit relationship.

5. The combination of claim 2 in which said housing is divided into said plurality of compartments by a plurality of transversely extending walls providing means for receiving said modules in a press-fit relationship, and each of said walls has a central opening for permitting said movable switch member to slide through said openings.

6. The combination of claim 5 in which one of said modules has a stop means and another one of said modules has another stop means and in which said movable switch member has cooperating means for engaging one of said stop means as said movable switch member is moved in one direction and for engaging the other stop means when said movable switch member is moved in the other direction.

7. The combination of claim 3 in which said housing is divided into said plurality of compartments by a plurality of transversely extending walls providing means for receiving said modules in a press-fit relationship, and certain of said walls have central openings for receiving said housing members and permitting said movable switch member to slide through said openings.

8. The combination of claim 7 in which one of said modules has a stop means and another one of said modules has another stop means and said housing members are longitudinally spaced along said movable switch members, one of said housing members engaging one of said stop means as said movable switch member is moved in one direction and the other of said housing members engaging the other of said stop means as said movable switch member is moved in the other direction whereby the movement of said movable switch member is limited in either direction of movement.

References Cited

UNITED STATES PATENTS

1,471,859	10/1923	Patton	200—77
2,921,166	1/1960	Few et al.	
2,649,514	7/1953	Ballou.	
2,874,245	2/1959	Moyer	335—131
3,188,405	6/1965	Scheib.	
3,238,329	3/1966	Russo.	
3,238,341	3/1966	Haydu.	

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U.S. Cl. X.R.

200—166, 47