Oct. 28, 1958 O. L. TAYLOR ET AL 2,858,384

ROTARY SWITCH

Filed March 9, 1956 3 Sheets-Sheet 1

Fig. 1.

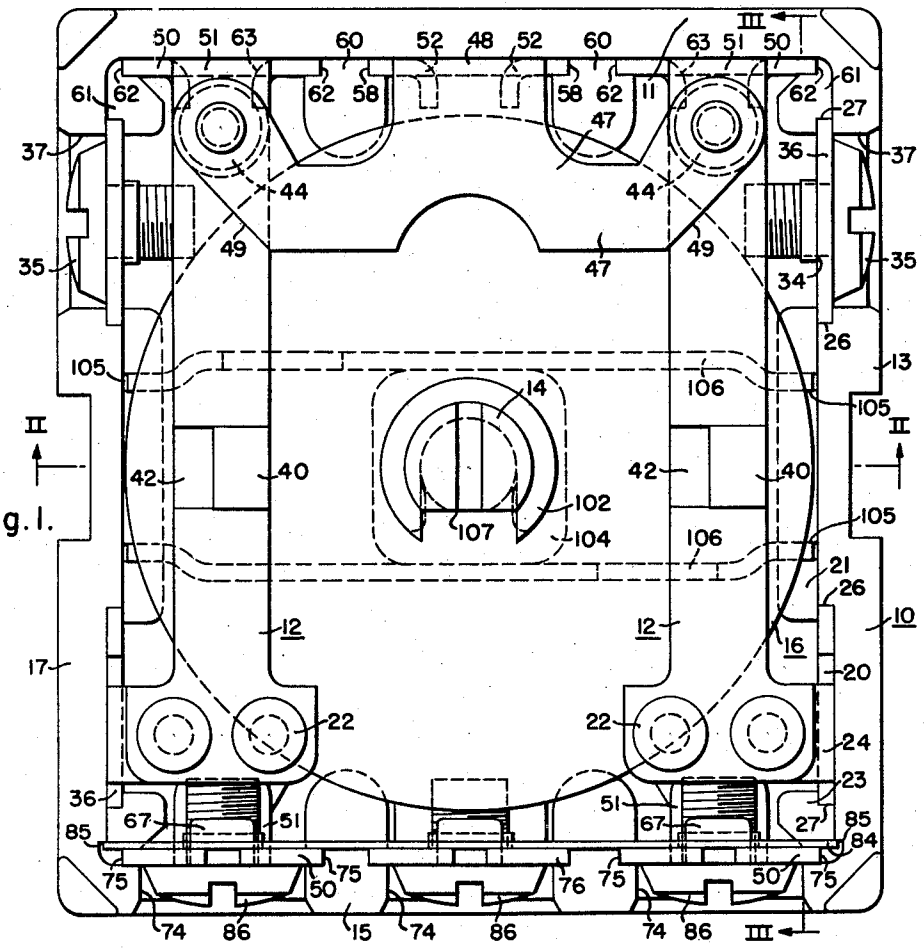
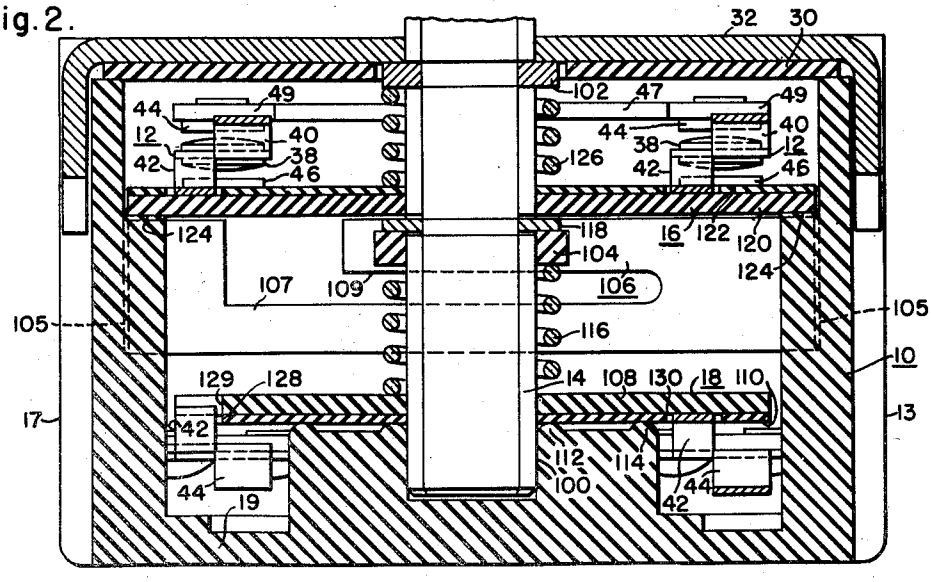


Fig. 2.



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ROTARY SWITCH

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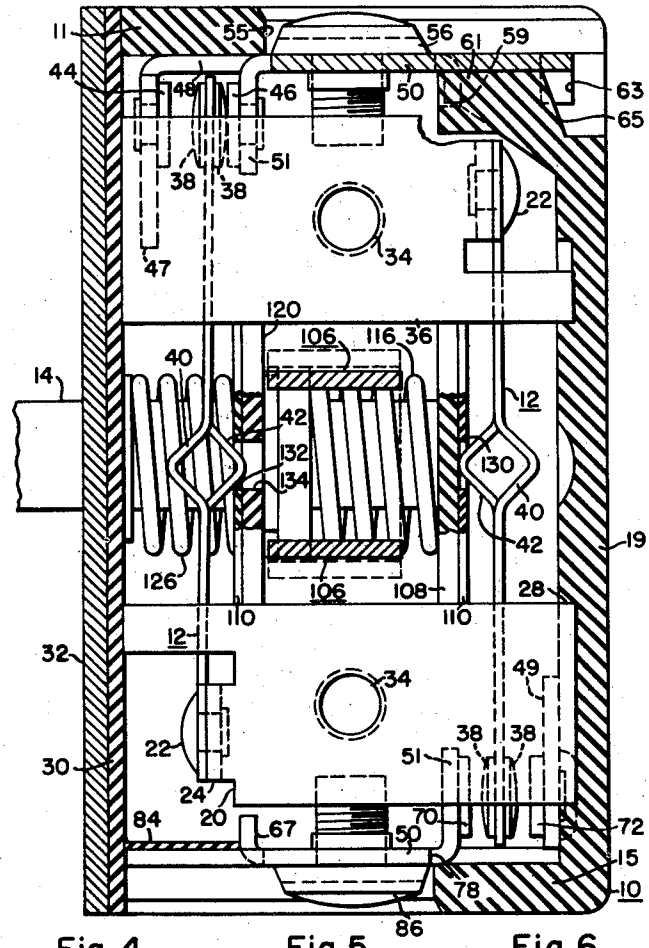


Fig.3.

Fig.4.

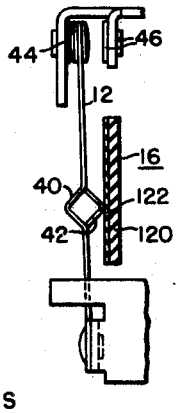


Fig.5.

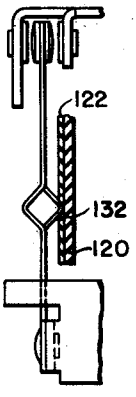
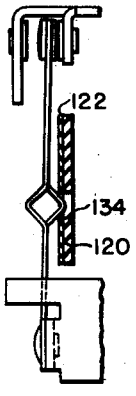


Fig.6.



WITNESSES

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ROTARY SWITCH

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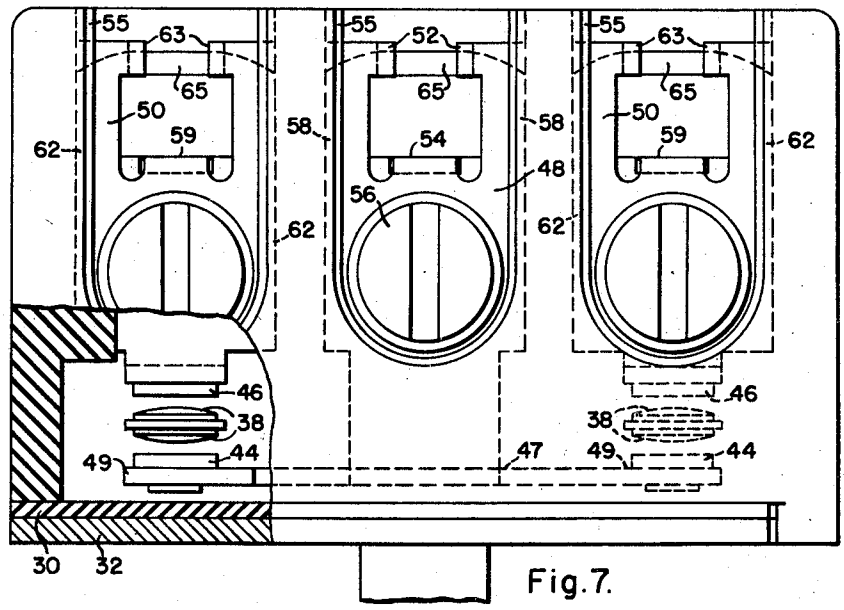


Fig.7.

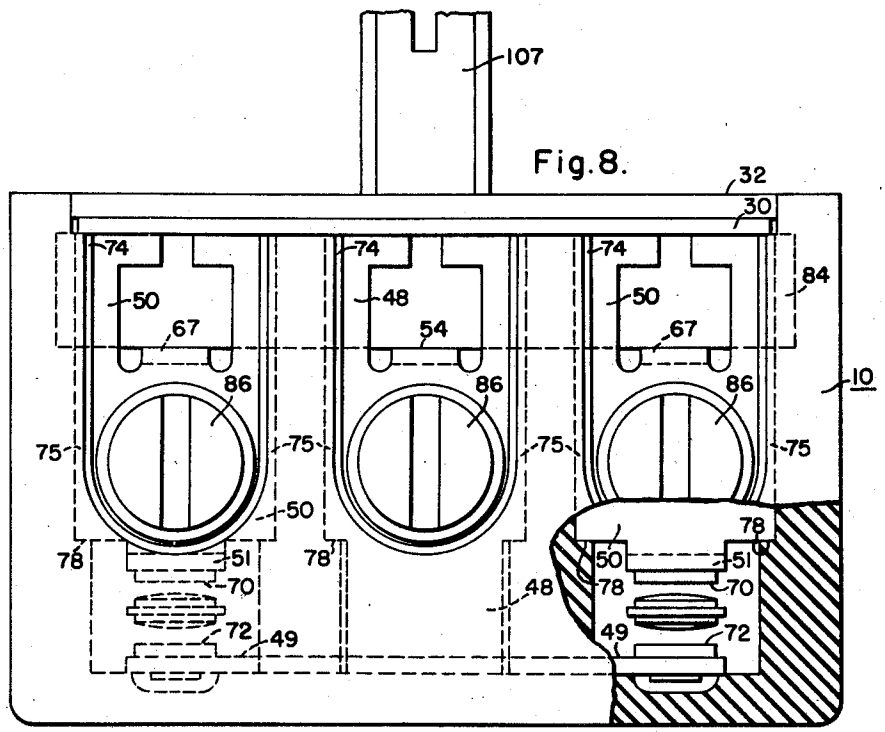


Fig.8.

United States Patent Office 2,858,384 Patented Oct. 28, 1958

2,858,384

ROTARY SWITCH

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Application March 9, 1956, Serial No. 570,567

18 Claims. (Cl. 200—6)

This invention pertains to switches and more particularly to multiple position rotary switches.

The usual type of multiple position switch uses either a blanked cam of an insulating material, such as molded plastic, or a cam molded of plastic for positioning the moving contacts of the switch. While multiple position switches using blanked or molded cams are successful, the expense of fabricating cams of this type is considerable and in addition, a different cam must be fabricated when a different sequence of moving the switch arms is desired. The high cost of fabricating a blanked cam arises from the fact that the camming surface is formed on the outer periphery of the cam and thus a separate blanking die must be built for each different cam. A similar problem arises in forming molded cams where the camming surface is formed either on the outer periphery of the cam or on one or both of the flat surfaces of the cam or even in a groove molded into the cam section. Here again, in order to vary the shape of the cam to vary the sequence of moving the switch arms of the switch, a new molding die must be built for each different cam.

Also, in previous switches, some means was necessary for adjusting the switch arms after the switch was assembled in order to compensate for errors which accumulated during manufacturing of various parts of the switch. These errors accumulate from the various manufacturing tolerances of the individual parts of the switch, and in some cases when the switch is assembled the switch arm is out of adjustment and cannot be properly moved to each of its desired positions by rotating the actuating cam, and thus must be altered so that the switch can operate. Previous rotary switches also used numerous small individual parts which greatly increased the cost of manufacturing and assembling the switches.

The rotary switch of this invention eliminates the above problems by providing a unique design of an actuating cam which utilizes two disc-shaped members blanked from a suitable sheet of insulating material, such as molded plastic or fiber. The two disc members are provided with a series of circumferentially spaced openings. One of the disc members is provided with fewer openings than the other disc and the openings in both discs are spaced so that they will be in alignment when the discs are superimposed on each other. A cam follower portion is formed on each of the movable switch arms of the switch and is so arranged that it will project into the openings in the discs and actuate the movable switch arm in a predetermined sequence as the cam is rotated. Thus all that is necessary to change the sequence of operation of the moving contact is to relocate the aforesaid openings. This can be easily done by the use of a relatively inexpensive piercing die which can be used for forming the openings in any desired disc.

The switch of this invention also utilizes a number of common parts which can be positioned in the housing of the switch in various ways to provide various switching actions thus eliminating the cost of fabricating many different parts necessary in former switches. The switch of this invention also eliminates the need for adjusting the movable contacts after the switch is assembled, by mounting all of the various parts on the molded base or providing positioning surfaces on the base for the remaining parts, thus eliminating the possibility of an accumulation of manufacturing tolerances.

Accordingly, the principal object of this invention is to provide a multiple position rotary switch which utilizes a novel construction for the actuating cam consisting of two disc-shaped members having a plurality of circumferentially spaced openings.

Another object of this invention is to provide a novel multiple position rotary switch in which the accumulation of manufacturing tolerances is eliminated by positive location of the various parts on the base of the switch.

Another object of this invention is to provide a multiple position rotary switch with unique terminal parts which are all common and can be easily interchanged with each other, thus eliminating the need for many individual small pieces. The elimination of the many small parts greatly simplifies the construction of the switch, thus greatly reducing its cost.

Other objects and advantages of this invention can be more easily understood from the following detailed description of a preferred embodiment thereof, when taken in conjunction with the attached drawings, in which:

Figure 1 is a top view of the switch with the cover removed;

Fig. 2 is a vertical section of the switch taken along the line II—II of Fig. 1, showing the means for positively locating the actuating cams;

Fig. 3 is an end section of the switch taken along line III—III of Fig. 1, showing the method by which the switch arms are actuated by the actuating cams;

Figs. 4, 5 and 6 are partial elevation views of one of the switch arms with the actuating cam shown in section, illustrating three different positions of the movable end of the switch arm;

Fig. 7 is an end view looking at the upper end of the switch shown in Fig. 1 showing the means used for mounting the stationary contacts in the base of the switch; and

Fig. 8 is an end view looking at the bottom end of the switch shown in Fig. 1 and showing the means used for mounting the stationary contacts at the other end of the switch.

The switch shown in Figs. 1, 2 and 3 consists of a hollow molded base 10 in which the movable switch arms and stationary contacts are mounted. A shaft 14 is rotatably supported by a circular recess 100 in the base and has an upper end which projects through the removable top cover 32. Mounted on the shaft are two actuating cams 16 and 18 which move the movable switch arms 12 through a predetermined sequence to engage the various stationary contacts.

The hollow base 10, which has side walls 11, 13, 15, 17 and a bottom wall 19 may be fabricated in any desired manner such as by molding, and should preferably be formed of an insulating material that can be easily molded, such as a plastic material. The upper right-hand switch arm 12 of Fig. 2 is fastened to a portion 24 which projects at right angles from the main portion of a supporting plate 20, by any desired means such as rivets 22. The supporting plate 20 is mounted in the base 10 by means of two vertical grooves 26 and 27 formed in a thickened portion 21 of side wall 13 and a thickened corner portion 23 between side walls 13 and 15, respectively. The supporting member 20 slides into these grooves during assembly and seats in a recess 28 formed in the bottom wall of the molded base as shown in Fig. 3. The supporting plate 20 is retained in position by an insulating plate 30 formed of any suitable material, such as fiber, which in turn is held in place over the open top of the base 10 by the removable top cover 32. The top cover 32 may be attached to the base

10 by any desired means such as small screws, not shown, which pass through openings in the cover and thread into the base 10.

The switch arm 12 shown at the upper left side of Fig. 2 is attached to a supporting plate 36 similar in construction to supporting plate 20 by means of rivets 22 in the same manner as described above. The supporting plate 36 is retained in the base 10 in the same manner as described for supporting plate 20. The two switch arms 12 positioned in the bottom the switch, as shown in Figs. 2 and 3, are attached to two additional supporting plates 20 and 36, respectively. The two additional supporting plates 20 and 36 are inverted from the position of the previously described supporting plates as shown in Fig. 3, and are retained in the base in the same manner as the other supporting plates. Each of the supporting plates 20 and 36 is provided with a tapped opening 34 so that a cap screw 35 may be used for attaching a suitable conductor to each of the supporting plates. The side wall 13 is provided with openings 37 so that the conductor can be attached to the supporting plates 20 and 36. Of course, the supporting plates and the switch arms 12 should all be formed of a suitable electrical conducting material, such as copper or brass, so that current from the conductor may flow to the end of the movable contact member. In addition, the switch arms should be formed of a resilient material, such as spring copper or brass, or an alloy thereof, so that they will always assume one normal position and the actuating cams may move them to their other positions.

This invention provides a simple means using only one design of movable switch arm 12 and two different supporting plates 20 and 36, whereby four switch arms may be mounted on the base 10. The use of only two different styles of supporting plates 20 and 36 greatly simplifies the manufacture and assembly of the switch, since only a relatively small number of different parts are necessary. Also, by mounting the supporting plates directly on the base and providing recesses in the bottom wall of the base in which they can seat, the possibility of manufacturing tolerances accumulating to where it would be necessary to provide an adjustment of the switch arms 12 after the switch is assembled is substantially eliminated.

Each of the switch arms 12 is provided with a suitable button-shaped contact 38 on each side of its free end. The contact 38 may be formed of any desired electrical conducting arc resistant material, such as silver or a silver alloy, and is attached to the end of a switch arm 12 by any well known means, such as welding, riveting or silver soldering. A cam follower portion 42 in the shape of an integral angular projection is bent out from the central portion of each of the switch arms 12. A similar portion 40 is bent out in the opposite direction from the cam follower 42 on each of the switch arms 12, in order that the switch arm 12 will remain straight. It is desirable to have the width of the cam follower portion 42 narrower than the width of the switch arm 12 so that the cam follower portion 42 may project into the openings formed in the actuating cams, to be described later, without requiring a large opening in the cam. This allows the use of smaller openings in the actuating cams, thus allowing the actuation of two of the switch arms 12 by one cam. For a given size of switch, if the full width of the switch arms 12 were formed as a cam follower projection, it would necessitate a correspondingly larger opening in the actuating cam, thus requiring a separate actuating cam for each of the switch arms 12.

An upper stationary contact 44 is provided for each of the switch arms 12 that are mounted in the upper portion of the base 10. The contacts 44 are attached to two ears 49 which project outwardly and in opposite directions from the central portion 47 of a common supporting member 48, by any desired means such as riveting, and are formed from an arc-resistant conducting material, such as silver or a silver alloy. The common supporting member 48 is formed of a conducting material, such as copper, or brass. The common supporting member 48 is mounted in the base 10 by means of two vertical grooves 58 formed in two spaced enlarged portions 60 on the side wall 11 of the base. A portion 54 of the member 48 is bent inwardly at right angles to the central portion of the member 48 and rests on a horizontal surface formed in the base 10, and serves to limit inward movement of the supporting member 48. Two additional tabs 52, shown in Fig. 7 at the bottom of the supporting member 48 are bent inwardly under an inclined ledge 65 formed on the outer side of the side wall 11 to lock the supporting member in place against upward movement. A cap screw 56 which threads into the central portion of the supporting member 48 is provided for attaching a conductor to the supporting member. A U-shaped opening 55 is formed in the side wall 11 to allow the conductor to be attached directly to the supporting member 48.

Separate stationary contacts 46 are provided on the lower side of each of the switch arms 12 which are mounted in the upper portion of the base 10. Each of the contacts 46 are attached to a right angle projection 51 formed at the upper end of a supporting member 50 by any desired means, such as riveting. The contacts 46 are formed of an arc-resistant conducting material such as silver or an alloy thereof, and the supporting members 50 should be formed of a conducting material such as copper or brass. Each of the supporting members 50 slide into two grooves 62 which are formed in the enlarged portion 60 and two enlarged corners 61 between the two side walls 11 and 17, and the side walls 11 and 13, respectively. The supporting members 50 are locked in position by portion 59 which is bent inwardly over the top of a ledge formed in the base 10 as shown in Figs. 3 and 7, and a pair of tabs 63 at the lower portion which are bent inwardly under the bottom surface of the above-mentioned ledge 65. The lower stationary contact 46 of the other movable contact 12 is mounted on a second supporting member 50 which is secured in the same manner as described above.

The stationary contacts 44 and 46 are thus secured to supporting members 48 and 50, respectively, which are positively locked to the base 10. By providing the inwardly projecting portion 54 and the tabs 52 on the supporting member 48, it is positively located on fixed surfaces of the base 10, thus positively positioning the contacts 44 in relation to the switch arms 12. A similar structure is used to positively locate the lower fixed contacts 46. It can thus be seen that the fixed contacts 44 and 46 are positively located relative to a fixed surface of base 10, in order to eliminate any accumulation of tolerances. By eliminating any accumulation of manufacturing tolerances, it is not necessary to provide any means for adjusting the switch arms 12 or the fixed contacts after the switch is assembled.

Stationary contacts 70 and 72 are provided on opposite sides of the free end for each of the switch arms 12 which are mounted in the lower portion of the base 10. Each of the upper fixed contacts 70 as shown in Fig. 8 is attached to a right angled portion 51 projecting from a supporting member 50 which slides into two grooves 75 formed in enlarged portions of the side wall 15 and in the corners of base 10. The bottom edge of the supporting member 50 seats at each side on an inwardly projecting ledge 78 formed in the bottom of the locating grooves 75 mentioned above. A small portion 67 on each supporting member 50 projects inwardly at right angles to the main body of the supporting member and is used in conjunction with a locking strip 84 to lock the supporting members 50 in position. The locking strip 84 extends across the tops of the projections 67 and is prevented from moving upward by the top insulating plate 30 previously described, and is prevented from mov-

ing laterally by abutments 85 formed in the enlarged corners of the base 10 which retain the ends of the locking strip 84 against the supporting members 50. The bottom two stationary contacts 72 are attached to ears 49 which project at right angles from a common supporting member 48 which is mounted and locked in position in the base 10 in the same manner as described for the supporting members 50 which carry the fixed contacts 70. The locking strip 84 serves to lock the two outer supporting members 50 in position and the supporting member 48, as shown in Figs. 1 and 8. Cap screws 86 which thread into openings in the supporting members 48 and 50, respectively, are provided so that conductors may be attached to the supporting members. U-shaped openings 74 are formed in the side wall 15 so that the conductors may be connected directly to the members 48 and 50. The supporting members 48 and 50 are identical in design with those described above except they are installed in an inverted position in Fig. 8 from the position shown in Fig. 7. Of course, the mounting of the supporting members varies, those in Fig. 7 being locked in position by deformable portions of the members which engage a portion of the base 10 and those in Fig. 8 being locked in place by a laterally extruding portion and top cover 32.

This invention thereby provides means whereby the stationary contacts for the switch arms 12 which are mounted in the bottom portion of the base 10 can be accurately located from fixed surfaces formed on the base 10. These fixed contacts are mounted on supporting members identical to those used for supporting the fixed contacts in the upper portion of the base 10. Thus, only two different designs of supporting members are necessary to support the eight fixed contacts, resulting in a large reduction in the number of different members required for the switch. Any accumulation of manufacturing tolerances is substantially eliminated by locating the contacts on fixed surfaces of the face, thus making it unnecessary to adjust the switch arms 12 after the switch is assembled.

Referring now to Fig. 2, there is shown means whereby the shaft 14 may be rotatably supported in the base 10 by means of the circular recess 100 formed in the central portion of the base. The shaft 14 is prevented from moving axially upwardly by a snap ring 102 which fits in a groove formed in the upper portion of the shaft and contacts the lower surface of the top cover 32. Downward movement of the shaft 14 is prevented by the bottom of the shaft contacting the bottom of the circular recess 100. An indexing cam 104 is mounted on the central portion of the shaft 14 and is caused to rotate with the shaft 14 by means of a flat surface 107 formed on the shaft and a similarly shaped opening. Two indexing springs 106, the ends of which are retained in vertical grooves 105 formed in opposite sides of the base 10, are used for stopping the indexing cam 104 in each of its positions as the shaft 14 rotates. The indexing springs 106 have a continuous portion 107 at the bottom and a portion 109 extending from only one end in order to increase their flexability. The portion 109 engages the flat surfaces on the indexing cam 104. While the indexing cam is shown as having four flat sides, it of course can be of any desired configuration depending upon the number of positions of the switch. The indexing cam 104 is prevented from moving upward by a second snap ring 118 which fits in a cooperating groove formed in the central portion of the shaft 14. Downward movement of the cam 104 is prevented by the spring 116, to be described below.

Two locating surfaces in the form of circular ridges 112 and 114 are formed on the bottom wall of the base 10 and are used for locating the actuating cam 18. A coiled helical spring 116 which surrounds the lower portion of the shaft 14 is provided for urging the lower surface of the actuating cam 18 into engagement with the locating ridges 112 and 114. The spring 116 reacts upwardly against the lower surface of the indexing cam 104, thus forcing the cam upwardly into engagement with the snap ring 118 previously described. Inwardly projecting shoulders 124 are formed on opposite sides 13 and 17 of the base 10 and are used for locating the upper actuating cam 16. A second helical spring 126 is provided on the shaft 14 for urging the lower surface of the actuating cam 16 into engagement with the shoulders 124 as shown in Fig. 2. The spring 126 reacts upwardly against the lower surface of the snap ring 102, previously described.

By providing locating surfaces which are formed on the base 10 for the actuating cams 16 and 18, the exact location of the cams relative to the base is insured and any accumulation of tolerances during the assembly of the switch is substantially eliminated. Also by providing separate helical springs 116 and 126 which react against separate snap rings 118 and 102 respectively, there is no need for accurate balancing of the spring forces so that the two separate actuating cams are properly located. The elimination of the necessity of balancing the spring forces and the use of locating surfaces which are formed on the base 10 greatly simplifies the assembly of the switch, thus greatly reducing its cost.

The lower actuating cam 18 consists of two disc-shaped members 108 and 110 which are fabricated from any desired insulating material, such as a laminated resinous material. The disc 110 is provided with a plurality of circumferentially spaced openings 128 which are located on the outer periphery of the disc. A second series of circumferentially spaced openings 130 is also provided in the disc 110 and is located closer to the center of the disc 110 than the openings 128. The number of openings 128 and 130 in each group will, of course, depend upon the desired movement of the switch arms 12 which are mounted in the lower portion of the base 10 for each rotation of shaft 14. A plurality of circumferentially spaced openings 129 are provided in the disc 108 and are spaced from the center of the disc 108 so that they will align with some of the openings 128 in the disc 110 when the two discs are superimposed to form a complete cam 18. A second series of circumferentially spaced openings (not shown) is also formed in the disc 108 and is spaced from the center of the shaft 14 so that these openings will align with some of the openings 130 in disc 110, previously described. The number of openings formed in the disc 108 will, of course, depend upon the desired movement of the movable contacts 112, but generally, there should be fewer openings in the disc 108 than in the disc 110. The discs 108 and 110 each have a D-shaped center opening which fits the shaft 14 and the flat of the D is positioned so that holes in disc 108 align with holes in disc 110. The D-shaped openings in the discs will prevent relative rotation between them when the cam is rotated. The upper actuating cam 16 is formed of two disc-shaped members 120 and 122 similar to the discs 108 and 110 respectively. The discs 120 and 122 are also provided with a plurality of circumferentially spaced openings similar to those described for the discs 108 and 110. The series of openings in the discs 120 and 122 are spaced at different distances from the center of the discs so that both of the switch arms 12 mounted in the upper portion of the base 10 may be actuated by the same cam.

The operation of one of the switch arms 12 mounted in the upper portion of the base 10 by the actuating cam 16 is shown in detail in Figs. 4, 5 and 6. As seen in Fig. 4, when the cam follower portion 42 of the switch arm 12 rests on the upper surface of the disc 122, the movable contact will be held in engagement with the upper stationary contact 44. When the cam 16 is rotated so that the cam follower portion 42 may project through an opening 132 formed in the disc 122 and rest on the upper surface of the disc 120, the switch arm 12 will be held at a neutral or "off" position, as shown in Fig. 5. When the actuating cam 16 is rotated still further so

that the cam follower portion 42 of the switch arm 12 can project through the aligned openings 132 and 134 in both of the discs 122 and 120 as shown in Figs. 3 and 6, the movable contact will be in engagement with the lower stationary contact 46 which is the normal or biased position of the switch arm 12. The number and location of openings in the various discs which are used for the actuating cams 16 and 18 will, of course, vary from switch to switch depending on the desired sequence of operation of the switch. Even though the number and location of the openings on the various discs will change from switch to switch, the discs may easily be fabricated without the use of expensive dies or molds as was previously required, since the openings may be formed by a simple punching operation. This operation can easily be performed with one die which can be used for all of the various discs by using any well known means for properly locating the openings. This invention thus provides a very inexpensive means whereby actuating cams for multiple position switches can easily be fabricated without the use of expensive dies or molds. Also, the sequence of operation of a multiple position switch can easily be changed without undue expense or difficulty.

This invention also provides a multiple position switch having four movable switch arms and eight stationary contacts, yet requires only two different types of supporting plates to support the switch arms and only two different types of supports for the stationary contacts. The reduction in the number of different types of supporting members required reduces the cost of producing the parts and thus the final cost of the switch.

While only a preferred embodiment of this invention is herein shown and described, it is, of course, susceptible to many modifications and changes without departing from the broad spirit and scope of the invention. Accordingly, this invention should not be limited to the particular embodiment thereof described above, but should be interpreted broadly and limited only as required by the prior art.

We claim as our invention:

1. A multiposition switch comprising, a hollow base having an open top, a removable top cover for said base, at least one movable switch arm having one end mounted in said base and having the other end free to move, at least one fixed contact mounted in said base adjacent said free end of the arm, a rotatable shaft supported in said base and having one end projecting through said top cover, a switch actuating face type cam slidably but non-rotatably mounted on said shaft, a locating surface formed on said base in the path of sliding movement of said cam, and biasing means mounted on said shaft for urging one surface of said cam into engagement with said locating surface to locate said cam in a predetermined axial position on said shaft with respect to said base where it is engageable with said switch arm to operate the latter into and out of engagement with said fixed contact, whereby said cam is located in said predetermined axial position independently of any longitudinal motion of said shaft.

2. A multiposition switch comprising, a hollow base having an open top, a removable top cover for said base, at least one moving switch arm having one end mounted in said base and having the other end free to move, at least one fixed contact mounted in said base adjacent said free end of the arm, a rotatable shaft supported in said base and having one end projecting through said top cover, a switch actuating cam slidably but non-rotatably mounted on said shaft, said cam comprising a pair of superposed disc-shaped members, each of said discs having a plurality of circumferentially spaced openings, one of said discs having fewer openings than the other of said discs, the openings in said one disc being aligned with the openings in said other disc, a cam follower portion on said movable switch arm biased to engage the outer surface of said other disc as said cam is rotated, a locating surface formed on said base in the path of sliding movement of said cam, and biasing means mounted on said shaft for urging said cam into engagement with said locating surface to locate said cam at a predetermined axial position on said shaft with respect to said base where it is engageable with said switch arm to operate the latter into and out of engagement with said fixed contact.

3. A multiple position switch comprising, a hollow base having an open top, a removable top cover for said base, a plurality of switch arms mounted in said base, each of said switch arms comprising a resilient member having one end secured in said base and having the other end free to move, a pair of spaced contacts secured to said base on opposite sides of each of said free ends, a shaft rotatably supported in said base, and projecting through said cover, means secured to said shaft and engaging the under surface of said top cover for axially positioning said shaft, at least one disc-shaped switch actuating cam slidably but non-rotatably mounted on said shaft, a cam locating surface formed on said base in the path of sliding movement of said cam, biasing means mounted on said shaft for urging one surface of said cam into engagement with said locating surface at a predetermined axial position with respect to said base where it engages said switch arms to move them into and out of engagement with said fixed contacts, said cam comprising a pair of superposed discs, one of said discs having a plurality of circumferentially spaced openings, the other of said discs having fewer circumferentially spaced openings than said one disc, openings in said other disc being spaced so as to align with openings in said one disc, and a cam follower portion formed on each of said switch arms and located so as to project into said spaced openings as said cam is rotated.

4. A multiposition switch comprising, a hollow base having an open top, a removable top cover for said base, a pair of switch arms mounted in the upper portion of said base, a second pair of switch arms mounted in the lower portion of said base, each of said switch arms comprising a resilient member one end of which is secured in the base and the other end of which is free to move, a pair of spaced contacts mounted in said base on opposite sides of the free end of each of said switch arms, a shaft rotatably supported in said base and having one end projecting through said top cover, means secured to said shaft and in engagement with the lower surface of said top cover for retaining said shaft in said base, a pair of axially spaced switch actuating cams slidably but non-rotatably mounted on said shaft, a locating surface formed on said base for each of said cams and located in the path of sliding movement of said cams, separate biasing means mounted on said shaft for each of said cams for independently urging said cams into engagement with said locating surfaces to locate said cams in predetermined positions, each of said cams consisting of a pair of superimposed disc-shaped members, one disc of each of said pair of discs having a plurality of circumferentially spaced openings, the other disc of each of said pairs having fewer openings than said one disc, openings in said other disc being spaced so as to align with openings in said one disc, a cam follower portion projecting from each of said switch arms, said cam follower portions being spaced so as to project into said openings as said cams rotate to move the free end of each of said switch arms into and out of engagement with said fixed contacts.

5. A multiple position switch comprising, a hollow base having an open side, at least two switch arms mounted in said base each having one end free to move, the free ends of said switch arms being at opposite ends of said base, a contact mounted adjacent the free end of each of said switch arms, each of said contacts being supported adjacent one end of identical supporting members, the supporting member at one end of said base being

positioned by means of grooves formed in said end which extend inwardly from the open side of said base and locked in position by means of a laterally extending portion of said member which rests on a ledge formed in said one end and a deformed portion in engagement with the opposite side of said ledge, the other member at the opposite end of said base being inverted relative to the first mentioned member and positioned by grooves formed in said opposite end which extend inwardly from said open side of said base and locked in position by the bottom of said grooves and a locking strip, said locking strip being located on top of said laterally extending portion and held in place by a removable top cover, and means for moving said switch arms into and out of engagement with said contacts.

6. A switch comprising, means for mounting a plurality of fixed contacts in a hollow base having side walls and an open side comprising, a plurality of identical members for supporting said contacts adjacent one end of the members, at least one of said members being mounted in one side wall of said base by means of grooves extending inwardly from the open side of said base and locked in place by a laterally extending portion of said member which rests on a ledge projecting from said side wall, and a deformable portion which engages the opposite side of said ledge, the remainder of said identical members being inverted relative to the first mentioned member and mounted in the other side walls of said base by means of additional grooves formed in said other side walls and extending inwardly from said open side and locked in place by the bottom of said additional grooves and a locking strip positioned on top of said laterally projecting portion, said locking strip being held in place by a removable top cover.

7. A multiple position rotary switch comprising, a hollow base, at least one switch arm having a free end mounted in said base, fixed contacts mounted in said base adjacent said free end, a shaft rotatably mounted in said base and means carried by said shaft for actuating said switch arm, an indexing cam mounted on said shaft and an indexing spring mounted in said base for biasing said cam in predetermined positions, said indexing spring comprising a resilient member having a continuous portion which bridges said hollow base and having its ends secured in grooves formed in opposite sides of said base and a second offset portion extending from one end of said spring and having a free end portion engaging said indexing cam to bias it to predetermined positions.

8. A multiposition switch comprising a hollow base having an open top, a removable top cover for said base, at least two switch arms with one end mounted in said base and having the other end free to move, at least one fixed contact mounted in said base adjacent the free end of each of said switch arms, a rotatable shaft supported in said base and having one end projecting through said top cover, two spaced apart switch actuating cams slidably but non-rotatably mounted on said shaft, a locating surface formed on said base for each of said cams, said locating surfaces being located in the path of sliding movement of said cams, biasing means mounted on said shaft for urging one surface of each of said cams into engagement with said locating surfaces to locate said cams in a predetermined axial position on said shaft with respect to said base where they are engageable with said switch arms, respectively to operate the latter into and out of engagement with said fixed contacts.

9. A multiposition switch comprising, a hollow base having an open top, a removable top cover for said base, at least one moving switch arm with one end mounted in said base and having the other end free to move, at least one fixed contact mounted in said base adjacent said free end of the arm, a rotatable shaft supported in said base and having one end projecting through said top cover, means mounted on said shaft for limiting the axial movement thereof, a switch actuating cam slidably but non-rotatably mounted on said shaft, a locating surface formed on said base located in the path of sliding movement of said cam, spring biasing means mounted on said shaft and reacting between a fixed point on said shaft and one surface of said cam, said biasing means urging the other surface of said cam into engagement with said locating surface to locate said cam in an axial position on said shaft with respect to said base where it is engageable with said switch arm to operate the latter into and out of engagement with said fixed contact.

10. A switch comprising a hollow rectangular base having an open side, a first switch arm having one end free to move and the other end attached to a supporting plate at a point adjacent one end of the plate, said supporting plate being located in grooves formed adjacent one end in one side wall of said base which extend inwardly from the open side of the base, a removable top cover for the open side of the base, a second switch arm having one end free to move and the other end attached to a second supporting plate identical with the above-mentioned supporting plate but in inverted relation thereto, said second supporting plate being located by a second set of grooves formed in said one side wall of said base which extends inwardly from the open side of said base, means for securing said cover in place in engagement with the outer ends of said plates so that the latter are held in position by said removable top cover, means movably mounted in said base for moving the free end of each of said switch arms into and out of engagement with fixed contacts positioned adjacent the free end of each of said switch arms, the fixed contacts of said switch arms being supported by identical supporting members, each of said supporting members being located by a set of grooves formed in opposite end walls of said base which extend inwardly from the open side of said base, one of said supporting members being locked in position by a laterally extending portion and deformable portion of said member which engages a portion of said base, the other of said supporting members being locked in position by said laterally extending portion and said removable top cover.

11. A multiposition switch comprising, a base, at least one switch arm having one end mounted on said base for movement of at least the opposite free end in opposite directions, spaced contacts mounted on said base and located at opposite sides of said free end of the switch arm and in its path of movement, a shaft rotatably mounted on said base, at least one operating cam mounted on said shaft, said operating cam comprising a pair of superposed discs mounted on said shaft for rotation therewith, each of said discs having a plurality of circumferentially spaced openings therethrough, a projection on said switch arm of a size to enter said openings extending into proximity with said cam and biased to engage the outer surface of the adjacent one of said discs, said openings being located the same radial distance from said shaft as said projection so that their path will intersect said projection to operate said switch arm in a predetermined sequence as said shaft is rotated in one direction, and openings in said other disc aligned with only some of the openings in said one disc so that said one switch arm is operable by said cam into and out of engagement with each of spaced contacts and to an intermediate open circuit position.

12. A multiposition switch comprising, a base, a plurality of single pole double throw switches mounted thereon each having a switch arm which has one end mounted on said base and the other end free to move in opposite directions, a pair of spaced contacts mounted on said base adjacent opposite sides of the free end of each switch arm and in the path of movement thereof, at least one operating cam mounted for movement on said base to actuate said switch arms so that the free ends thereof engage and disengage said contacts in a predetermined sequence, said operating cam comprising a pair of superposed plate members mounted for movement together and having a

plurality of spaced openings therethrough some of which are aligned, a projection on each of said switch arms between the ends thereof and biased so as to engage the outer surface of one of said plate members, said projections being of a size to be received in said openings and located to intersect the path of movement of said openings so that when said projections are in contact with the outer surface of said one disc the switch arms engage one of said fixed contacts, when said projections are received in one of the openings in said one disc and engages the adjacent face of the other of said discs the arms occupy a central position, and when said projection extends through aligned openings in both of said discs the switch arms engage the other of said fixed contacts.

13. A multiposition rotary switch comprising a hollow base having an open side and a removable top cover, a pair of switch arms mounted at one end in the upper portion of said base, a second pair of switch arms mounted at one end in the lower portion of said base, the other end of each of said switch arms being free to move, a pair of spaced contacts mounted on said base at opposite sides of said other end of each of said switch arms, a shaft rotatably mounted in said base with one end of said shaft projecting through said top cover, an indexing cam mounted on said shaft, resilient means mounted in said base and engaging said indexing cam, a first positioning cam slidably but non-rotatably mounted on said shaft for operating said first pair of moving contacts, a second positioning cam slidably but non-rotatably mounted on said shaft for operating said second pair of moving contacts, means biasing each of said cams longitudinally of said shaft into engagement with bearing surfaces on said base, each switch arm of said upper pair of switch arms having a cam follower portion biased into engagement with an adjacent surface of said first positioning cam, each of said lower pair of switch arms having a cam follower portion biased into engagement with the adjacent surface of said second positioning cam, and each of said positioning cams comprising at least two superposed discs each having a plurality of circumferentially spaced openings, the openings in one disc of each pair being aligned with some of the openings in the other disc of said pair, and the cam surfaces engaged by said cam follower portions comprising the outer surface of the adjacent other disc with the path of movement of said openings intersecting said cam follower portion as said shaft is rotated.

14. A positioning cam for a multiple position switch comprising a pair of superimposed plates, means supporting said plates for movement together, a plurality of spaced openings through one of said discs and the other of said discs having fewer openings therethrough, the openings in the other disc being spaced and located in alignment with certain of the openings in said one disc.

15. A switch comprising a hollow rectangular base having an open side, a first switch arm having one end free to move and the other end attached to a supporting plate at a point adjacent one end of the plate, said supporting plate being located in grooves formed adjacent one end in one side wall of said base which extend inwardly from the open side of the base, a removable cover for the open side of the base, a second switch arm having one end free to move and the other end attached to a second supporting plate identical with the first-mentioned supporting plate but in inverted relation thereto, said second supporting plate being located in a second set of grooves formed adjacent the other end in said one side wall of said base which extend inwardly from the open side of said base, means for securing said cover in place in engagement with the outer ends of said plates so that the latter are held in position by said removable top cover, and means movably mounted in said base for moving the free end of each of said switch arms into and out of engagement with fixed contacts which are also mounted in said base adjacent the free end of each of said switch arms.

16. A multiposition switch comprising, a base, at least one switch arm having one end mounted on said base for movement of at least the opposite free end in opposite directions, spaced contacts mounted on said base and located at opposite sides of said free end of the switch arm and in its path of movement, an operating cam mounted for movement on said base to actuate said switch arm so that the free end thereof engages and disengages the contacts in a predetermined sequence, said cam comprising a pair of superposed plate members mounted for movement together and having a plurality of openings therethrough spaced in the direction of movement some of which are aligned, a projection on said switch arm biased into engagement with the outer surface of the adjacent plate member, said projection being of a size to enter said openings and located to intersect the path of movement of said openings so that when said projection engages said outer surface the switch arm engages one of said contacts, when said projection is received in an opening in said adjacent disc which is not aligned with an opening in the other disc the switch arm is at an intermediate position, and when said projection is received in aligned openings of both discs the switch arm engages the other contact.

17. A multiposition switch comprising, a hollow base having an open top, a removable top cover for said base, a pair of switch arms mounted in the upper portion of said base, a second pair of switch arms mounted in the lower portion of said base, each of said switch arms comprising a resilient member one end of which is secured in the base and the other end of which is free to move, a shaft rotatably supported in said base and having one end projecting through said top cover, means secured to said shaft and in engagement with the lower surface of said top cover for retaining said shaft in said base, a pair of axially spaced switch actuating cams slidably but non-rotatably mounted on said shaft, a locating surface formed on said base for each of said cams and located in the path of sliding movement of said cams, separate biasing means mounted on said shaft for each of said cams for independently urging said cams into engagement with said locating surfaces to locate said cams in predetermined positions, and cam follower portions on said switch arms in engagement with said cams, respectively, to be actuated thereby.

18. A switch comprising a hollow support having an open top, a removable top cover for said support, at least one movable switch arm having one end mounted in said support and having the other end free to move, at least one fixed contact mounted in said support adjacent said free end of the arm, a rotatable shaft supported in said support and having one end projecting through said top cover, a switch actuating face type cam slidably but non-rotatably mounted on said shaft, a locating surface formed on said support in the path of sliding movement of said cam, and biasing means mounted in said support for urging one surface of said cam into engagement with said locating surface to locate said cam in a predetermined axial position on said shaft with respect to said support where it is engageable with said switch arm to operate the latter into and out of engagement with said fixed contact, whereby said cam is located in said predetermined axial position independently of any longitudinal motion of said shaft.

References Cited in the file of this patent

UNITED STATES PATENTS

2,161,243	Borton	June 6, 1939
2,429,084	Woodson	Oct. 14, 1947
2,454,646	Gates	Nov. 23, 1948
2,480,410	Hammerly	Aug. 30, 1949
2,506,653	Soreng et al.	May 9, 1950
2,743,330	Ludwig	Apr. 24, 1956