July 4, 1967 E. A. JONES ETAL 3,329,792

MULTICIRCUIT PUSHBUTTON SWITCHES

Filed Sept. 7, 1966 3 Sheets-Sheet 1

Fig. 1

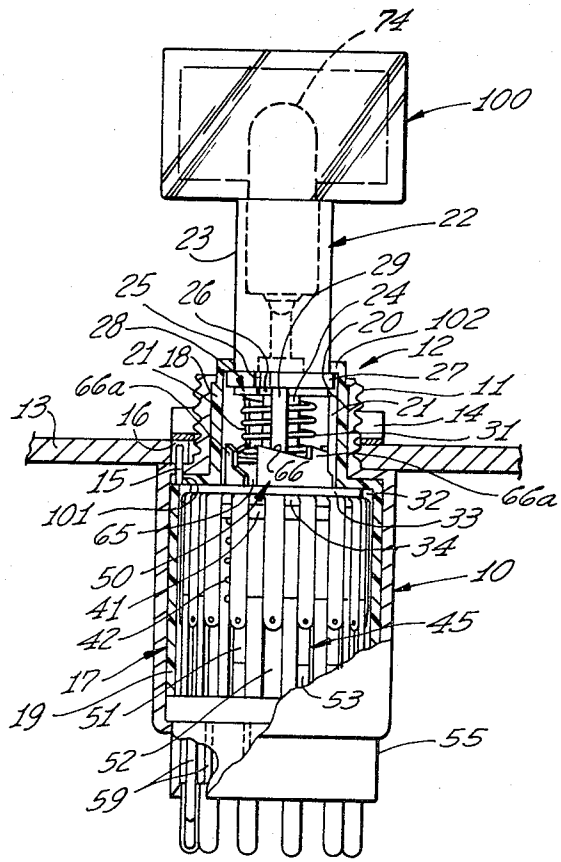


Fig. 2a

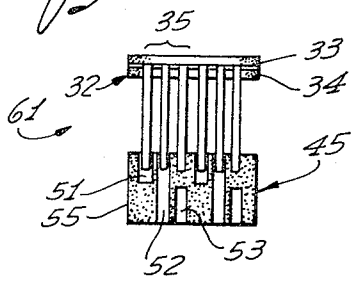
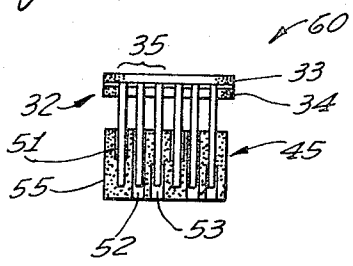


Fig. 2b



INVENTORS:
Edward A. Jones
Robert C. Carter

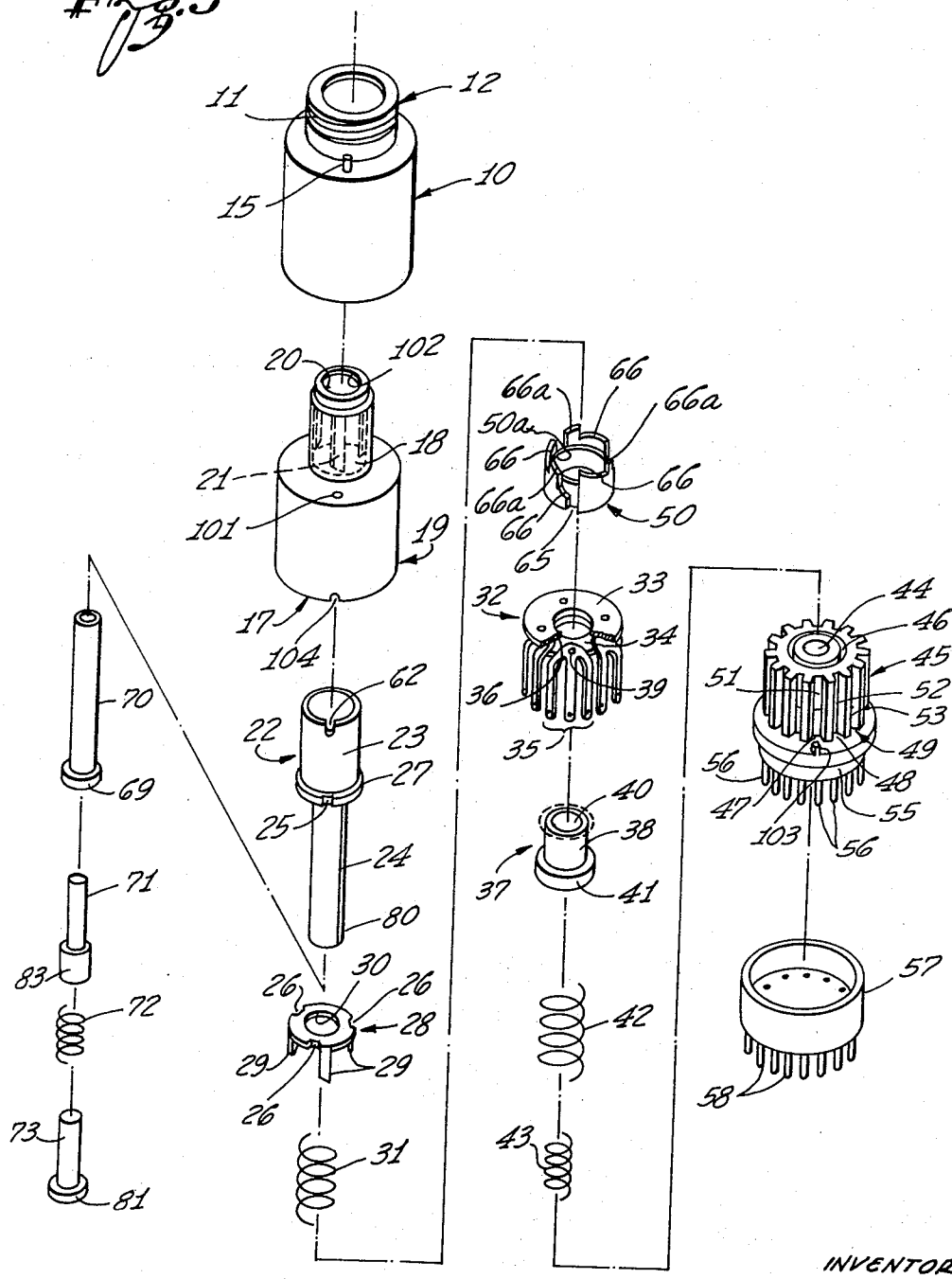
By Ralph M Braunstein

July 4, 1967 E. A. JONES ETAL 3,329,792

MULTICIRCUIT PUSHBUTTON SWITCHES

Filed Sept. 7, 1966 3 Sheets-Sheet 2

Fig. 3



INVENTORS:
Edward A. Jones
Robert C. Carter

By Ralph M. Brannan Jr.
ATTORNEY

July 4, 1967 E. A. JONES ET AL 3,329,792

MULTICIRCUIT PUSHBUTTON SWITCHES

Filed Sept. 7, 1966 3 Sheets-Sheet 3

Fig. 5

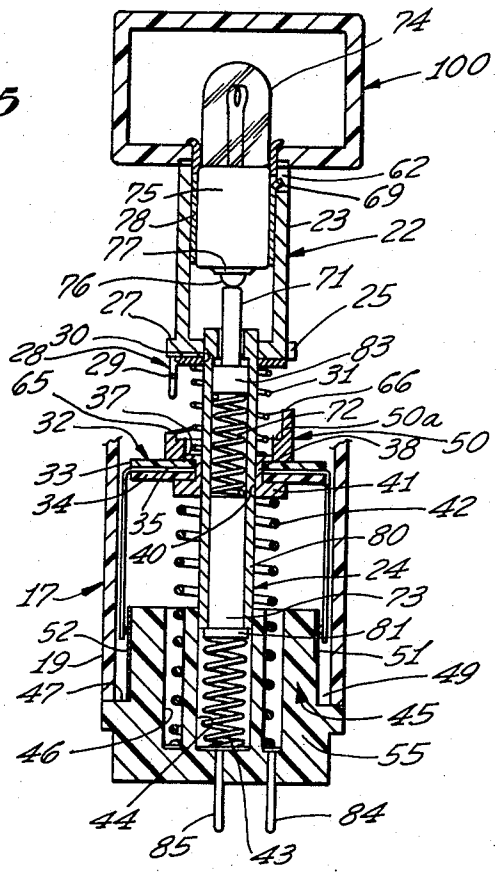
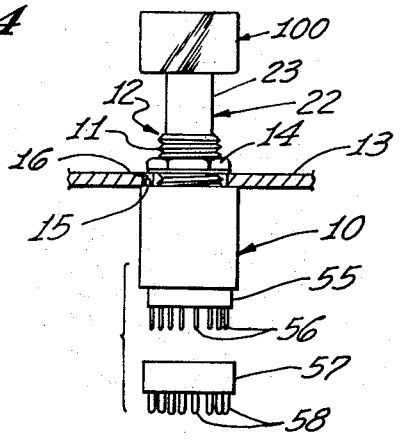


Fig. 4



INVENTORS:
Edward A. Jones
Robert C. Carter

By Ralph M Brumatti
ATTORNEY

United States Patent Office 3,329,792
Patented July 4, 1967

3,329,792

MULTICIRCUIT PUSHBUTTON SWITCHES

Edward A. Jones, Sylmar, and Robert C. Carter, Encino, Calif., assignors to Litton Precision Products, Inc., Van Nuys, Calif., a corporation of Delaware

Filed Sept. 7, 1966, Ser. No. 577,729
15 Claims. (Cl. 200—167)

ABSTRACT OF THE DISCLOSURE

The invention comprises a multicircuit pushbutton switch having a plurality of movable spring finger contacts riding in parallel grooves. A plurality of fixed contacts are disposed at various positions along the length of the grooves. Various of the contacts in each array may be interconnected. Electrical circuits are made and broken as the two arrays of contacts slide with respect to each other as actuated by a pushbutton mechanism including a rotary cam. A terminal header is provided to couple to the switch the circuits to be controlled.

This is a continuation in part of our application Ser. No. 444,687, filed Apr. 1, 1965, for "Push Button Switch," now abandoned.

This invention relates to electrical switches and, more particularly, to multicontact switch assemblies and pushbutton assemblies incorporated in such switches.

Illuminated pushbutton switching devices are used in the electrical and electronic fields, and in various industrial instruments to provide multicircuit switching and may include indication of the fact of the switching by a lamp incorporated therein. While this specification describes an illuminated switch, the same inventive concepts are equally applicable to a non-illuminated switch.

In accordance with one aspect of the invention, a multicontact electrical switch assembly includes a first and a second set of contact elements adapted for relative back-and-forth motion, between two distinct switch positions, of the contact elements of the first set with respect to those of the second set. In each set, the contact elements are spaced apart in a cylindrical configuration and the back-and-forth motion occurs axially of both configurations of contact elements.

In accordance with a second aspect of the invention, a multicontact electrical switch assembly includes a first and a second set of contact elements adapted for relative back-and-forth motion, between two distinct switch positions, of the contact elements of the first set with respect to those of the second set. Different ones of the contact elements of the second set are disposed at different locations along the path of relative motion of the contact element sets, so that at least one contact element of the second set is engaged by a corresponding contact element of the first set in only one of the two distinct switch positions.

In accordance with a third aspect of the invention, an electrical switch assembly having two distinct axial switch positions, as combined with a pushbutton actuating mechanism, the combination being such that alternate changes of switch positions are brought about as a result of sequential pressure applications to the pushbutton. The mechanism includes a rotatable and axially movable cam having an interrupted spiral-shaped cam surface for controlling said operation.

A variety of cam configurations can be used to provide different switching arrangements where two or three, or even more, distinct switch positions may be achieved. Thus, for more than two positions, each successive pressure application will turn the cam means through one-

third or other fraction of its cycle to position the contact elements at each such fraction of the cycle at different axial positions in order to achieve particular contact switching combinations.

In an illustrative embodiment of the invention, the pushbutton assembly comprises a rotating and axially movable cam with three identical cam surfaces upon which there rides a tripodal cam actuator which is resiliently urged against the cam surfaces. The pushbutton assembly is cooperatively engaged with a contact array comprising a plurality of dependent spring contact fingers extending skirt-like from and below the rim of an insulative supporting disc.

The contact fingers surround a fixed insulative fluted base, into the flutes of which are inserted contact elements that are engageable with the dependent contact fingers. The contact elements in the fluted base are of different lengths and are positioned so as to make contact with predetermined ones of the dependent contact fingers in the various distinct switch positions.

The fluted base is fixed in the switch assembly and the contact elements therein are connected with respective external terminal pins in the base for making external plug-in contact with circuit receptacles provided therefor. Alternatively, the base connections may be solder terminals of various types, contact blades, or socket receptacles.

In the illustrative embodiment of the invention, rotating cam and the movable contact array are positionable to upper or lower positions with respect to the fixed positions of the cam actuator and the fluted base. In each of its two positions, the contact fingers of the contact array make interconnections with various contact elements on the fluted base and a great variety of connection combinations may be obtained. The connections may be momentary, push-push, momentary snap types or hold-down types.

The actuating mechanism in the illustrative embodiment is such that successive downward pressures upon the pushbutton alternately position the spring finger contact array in its upper or lower position with respect to the fixed contacts in the fluted base so as to provide at least a two-position switching arrangement. The contact array is resiliently urged by a spring to a normally upper position.

It is an object of this invention to provide a pushbutton actuated switch for making multicircuit interconnections in electrical or electronic systems.

It is another object of this invention to provide a simple switch contact positioning means, actuated by a pushbutton cooperating therewith.

A further object of this invention is to provide a pushbutton actuated multicircuit switching means comprising a movable spring finger contact array axially positionable by a rotary cam with respect to a contact supporting base, or core, to make predetermined contact interconnections with the contacts on said core in different axial positions of said spring finger contacts array.

Yet another object of this invention is to provide in a pushbutton actuated multicircuit switch means for sequentially positioning contact arrays within said switch into one or another of a cycle of several contact positions in response to successive actuations of the pushbutton.

These and other objects of the invention will be clearly understood from the following more detailed description taken in conjunction with the accompanying drawings. The embodiment shown is, of course, merely illustrative and is not to be construed as a limitation of the invention, many variations and modifications of which are possible and may be made by those skilled in the art without exceeding the scope and spirit of the appended claims.

In the drawings:

FIGURE 1 is a partially cutaway and partially cross-sectional view of a switch according to this invention, showing internal components;

FIGURES 2*a* and 2*b* are schematic representations of the contacting portions of a switch according to this invention showing two different positions thereof;

FIGURE 3 is an exploded view of the components of the switch;

FIGURE 4 is an overall external view of a switch similar to that of FIGURE 1, reduced in size and including a typical socket connector therefor; and

FIGURE 5 is a cross-sectional view of a switch according to this invention, showing in detail the lamp circuit thereof.

Referring now to the figures generally and more particularly to FIGURE 1, a metallic switch housing **10** is shown having a threaded collar **11** at the neck portion **12** thereof for insertion in a panel or other mounting surface **13**. The switch housing **10** is held in place in mounting surface **13** by a nut **14**. A locating pin **15** is provided in housing **10** which may be positioned in an appropriate recess or hole **16** in panel or mounting surface **13** to receive pin **15** and prevent the switch from rotating in the panel **13**.

A plastic insulating cylinder **17** having an upper portion **18** and lower portion **19** fits into casing **10** to insulate the casing from interior components of the switch. It will be appreciated that the upper and lower portions **18** and **19** may be separate rather than integral, if such is desired for convenience of manufacture or assembly. It is desirable to provide means to prevent rotation of upper portion **18** during operation of the pushbutton mechanism as described below. In the illustrative embodiment, such rotation is prevented by an extension of pin **15** which protrudes inside housing **10** to engage a hold **101** in cylinder **17**. On the inner surface **20** of the upper portion **18** of insulating cylinder **17** inwardly projecting axially extending tracks or guides **21** of rectangular cross sections are provided. Two guides **21** may be seen in FIGURE 1 in exaggerated perspective in the cutaway portion of the upper portion **18** of cylinder **17**, but there are three such guides **21** in the illustrative embodiment, as shown in FIGURE 3. The lower ends of tracks or guides **21** are bevelled to match the cooperating surfaces of cam **50** as described further below.

Within insulating cylinder **17** is a plunger drive cylinder **22**. Drive cylinder **22** has an upper cup **23** and a guide pin **24** of smaller diameter depending therefrom. Cup **23** is slidable within upper portion **18** of insulating cylinder **17** and includes a flange **27** separating pin **24** from cup **23**. In the periphery of flange **27** are notches or grooves **25** to accommodate the tracks or guides **21** of the cylindrical upper portion **18** of cylinder **17**. There are three grooves **25** although only one is shown in FIGURE 3. Thus, plunger **22** is mounted for axial sliding motion within the upper portion **18** of cylinder **17** along the guides **21**, but it cannot rotate because notches **25** accommodate the guides or tracks **21**.

A cam actuator **28** having three dependent fingers **29** and a central aperture **30** fits over guide pin **24** and abuts flange **27** of plunger **22**. Adjacent the fingers **29**, three notches **26** are provided in the cam actuator **28**, each of the notches accommodating one of the guides **21** to permit axial sliding motion, but prevent rotation of the actuator. Consequently, both drive cylinder **22** and actuator **28** slide up and down along the tracks or guides **21**.

A spring **31** fitting over guide pin **24** and bearing with its lower end against the contact assembly described below, presses against cam actuator **28**, uring it upward against flange **27** of plunger drive cylinder **22**.

A spring finger contact assembly **32** is made up of two discs **33**, **34** between which at least one, preferably a number of contact groups **35** are riveted as shown in the cutaway portion **36** (FIGURE 3) of assembly **32**. A rivet **39** holds together each of the contact finger array groups **35** with lower disc **34**.

In the cutaway detail **36** the spring finger contacts are shown as a group **35** of three fingers. It should be clear that any contact combination of two or more fingers such as that designated **35** can be provided for whatever interconnection operation is desired in a switch according to this invention. The detailed operation as described further below will make this clear.

The assembly of upper and lower discs **33**, **34** over contact finger array groups **35** is held together by an eyelet-bearing arrangement **37** shown as it appears prior to peening over the top **38** thereof in the exploded view of FIGURE 3. The inner wall of opening **40** through eyelet-bearing **37** is the bearing surface for slidably guiding pin **24**.

The base or flange surface **41** of eyelet **37** rests upon spring **42** which fits about the guide pin **24**.

A ring-shaped cam **50** sits upon the upper disc **33** of spring finger contact array **32** with pin **24** extending through the cam. Thus, the cam is mounted for rotational motion about the axis of the assembly, when actuated for such motion. In addition, the cam is axially movable between two end positions, and in this axial motion the contact array assembly **32** follows the cam, as both the assembly **32** and the cam are urged upward by spring **42**, and moved downward upon actuation of the pushbutton. The cam **50** has three axially extending recesses, or slots, one being shown in FIGURE 3 as **65**, which separate three spiral-shaped ramps, such as **66**, about the periphery of the cam **50**. As a ring with three axially extending slots **65** would actually fall apart to form three separate pieces, the cam surfaces of cam **50** are supported by an internal, smaller diameter cylinder designated **50***a* in FIGURES 3 and 5. Of course, the entire cam **50**, including inner ring **50***a*, may be manufactured as one integral unit. The slots **65** with the inner ring **50***a* form axial recesses or channels which, in operation, alternately accommodate guides or tracks **21** and fingers **29** as explained in detail below.

Ramps **66** constitute cylindrical spiral or helical surfaces, each ramp being divided into two sections by an upward extension **66***a* which terminates in an edge constituting an upwardly shifted section of the spiral ramp, as shown in FIGURE 1. As illustrated, the width of each of the fingers **29** and protrusions **66***a* is about equal. To assure proper operation, each protrusion **66***a* is positioned toward the lower end of the ramp which it divides, so that the higher, wider portion, seen near the center in FIGURE 1, is sufficiently wide to receive simultaneously, one next to the other, one of the fingers **29** and one of the tracks or guides **21** passing through notches **25** and **26**, the guides having been partly omitted in FIGURE 1 for the sake of clarity. The lower continuation of a ramp **66**, appearing at the right-hand side of protrusion **66***a* in FIGURE 1, is illustrated as having about the width of a single finger **29**, or one guide **21** since in operation it accommodates only one of them at a time as explained further below.

The slots **65**, ramps **66** and ramp protrusions **66***a* cooperate with the cam actuator fingers **29** of cam actuator **28**, and guides **21** in the following manner.

Cam actuator **28** is raised and lowered within upper portion **18** of cylinder **17** by the application of pressure to pushbutton **100** and thereby to plunger **22**. As shown in FIGURE 1, pushbutton **100** is in its upper position. Actuator **28** is urged against flange **27** at the bottom of cup **23** by spring **31** which is partially compressed between actuator **28** and contact assembly **32**. Thus, actuator **28** is in its upper position as well. Also as shown in FIGURE 1, assembly **32** is in its upper position with respect to fluted base **45** and cam **50**, which rides atop assembly **32**, is in its upper position. Assembly **32** is urged upward by spring **42** which is partially compressed between assembly **32** and the bottom of annular groove or depression **46** in base **45**.

In the illustrated upper position of cam **50**, the bevelled lower edges of actuator fingers **29** bear against the uppermost portions of ramps **66**, while guides **21** extend downward into slots **65** with their leading vertical or axially extending edges abutting the trailing vertical or axially extending edges of cam **50** at the highest ends of ramps **66** thereby preventing rotation of cam **50** by the torque resulting from the pressure of fingers **29** on ramps **66**. As pushbutton **100** is moved downward by the application of pressure, plunger **22** is depressed and fingers **29** of actuator **28** bear against cam **50** causing it to move downward with respect to guides **21**, causing contact assembly to move downward with respect to fluted base **45**, and further compressing spring **42**. When cam **50** has moved downward to the point where the tops of ramps **66** are below the bevelled lower edges of guides **21**, it is able to rotate and does rotate as a result of the torque resulting from the pressure between fingers **29** of actuator **28** and ramps **66**. Rotation of actuator **28** is prevented by the engagement of guides **21** with notches **26**. Cam **50** rotates through a small angle until the vertical trailing edges of protrusions **66***a* come into contact with the vertical leading edges of fingers **29**. In this position of cam **50**, guides **21** are located above the uppermost portions of ramps **66** where, in the initially described configuration shown in FIGURE 1, fingers **29** were previously stationed.

If the pressure upon pushbutton **100** is now released, spring **31** expands, moving plunger **22** and actuator **28** with fingers **29** upward. When the bevelled lower edges of fingers **29** move above the tops of protrusions **66***a*, cam **50** is again enabled to rotate and does so as a result of the torque produced by ramps **66** bearing upwardly against the bevelled lower edges of guides **21** as cam **50** is urged upward by spring **42**. Cam **50** rotates through another small angle until the vertical trailing edges of protrusions **66***a* come into contact with the vertical leading edges of guides **21**. Actuator **28** and plunger **22** continue to move upward under the influence of spring **31** until flange **27** is stopped by an internal ridge **102** at the top of upper portion **18** of cylinder **17**, while cam **50** is locked in its lower position with respect to cylinder **17** and assembly **32** is held by cam **50** in its lower position with respect to fluted base **45** as shown in FIGURE 2(*b*).

If pressure is again applied to pushbutton **100**, plunger **22** is depressed, spring **31** is compressed and actuator **28** moves downwardly until the bevelled lower edges of fingers **29** contact the upper edges of protrusions **66***a*. As plunger **22** continues to move downward, fingers **29** move cam **50** downward with respect to guides **21**. When the upper edges of protrusions **66***a* descend below the bevelled lower edges of guides **21**, cam **50** again is enabled to rotate and does so initially as a result of the torque produced by the bevelled lower edges of fingers **29** bearing on the upper edges of protrusions **66***a*. After cam **50** rotates through an initial small angle, contact between fingers **29** and protrusions **66***a* ceases and cam **50** moves upwardly under the urging of spring **42** until the lower portions of ramps **66** contact the bevelled lower edges of fingers **29** and a torque is again produced which causes cam **50** to rotate through an additional small angle until fingers **29** drop into slots **65** and rotation is stopped by contact between the vertical leading edges of fingers **29** and the vertical trailing edges of ramps **66**. In this configuration, further axial upward movement of cam **50** is prevented by contact between the bevelled lower edges of guides **21** and the lower portions of ramps **66**.

If the pressure on pushbutton **100** is now released, plunger **22** and actuator **28** move upward as spring **31** expands. When the bevelled lower edges of fingers **29** move above the upper edges of ramps **66**, cam **50** is again enabled to rotate and does so as a result of the torque produced by the bevelled lower edges of guides **21** bearing on the lower portions of ramps **66**. Rotation continues through a small angle until guides **21** drop into slots **65** and the vertical leading edges of guides **21** come into contact with the vertical trailing edges of ramps **66**. With guides **21** in slots **65**, cam **50** is free for axial upward movement which continues under the urging of spring **42** until the upper portions of ramps **66** contact the bevelled lower edges of fingers **29**. Cam **50** and assembly **32** are then in their upper positions with respect to cylinder **17** and base **45**, and the switch is again in the configuration illustrated in FIGURE 1.

From the foregoing step-by-step recitation of the operation, it will be clear that in the illustrative embodiment every time the pushbutton **100** is pressed down and released again, the electrical contact assembly **32** is switched between one and the other of the two positions **60** and **61** shown in FIGURES 2(*a*) and 2(*b*). Each one of the steps of pushing down the button **100** and releasing it causes rotation of cam **50** which may be referred to as idling because the cam, though driven to rotate by cam action, does not drive any other element to rotate with it. The two stable end positions are reached when the guides, or tracks **21** are either accommodated by slots **65** (FIGURE 1 and upper position **61**, FIGURE 2(*a*)), or when stopped by protrusions **66***a*.

When guides **21** are in slots **65** of cam **50**, the adjacent ramp portions rest on fingers **29**, which then form a stop for further upward motion of the cam, and contact array **32** is in its upper position **61** as shown in FIGURE 2(*a*).

When guides **21** are against the wider portions of ramps **66** of cam **50**, and stopped from further motion by protrusions **66***a*, contact array **32** is in its lower position **60** as shown in FIGURE 2(*b*).

As also shown in FIGURE 5, guide pin **24** rests on spring **43** which is inserted in the center aperture **44** of contact base **45**.

Spring **42** rests in annular groove **46** in contact base **45**. Base **45** carries a protrusion **103** for engagement with a notch **104** in the lower edge of cylinder **17** to prevent relative rotation of cylinder **17** and base **45**.

The periphery of contact base **45** is fluted as shown at **47, 48, 49**, see also FIGURE 3. Within each of the flutes, i.e. axially extending grooves, is a contact member such as those designated **51, 52, 53**.

The grouping of fixed contact members **51, 52, 53** can be seen, particularly in FIGURE 2, to have the following arrangement in the flutes: contact member **51** is a short section near the top of base **45**; contact member **52** is a full-length contact member; and contact member **53** is a short member near the bottom of its flute in base **45**.

Thus, as may be seen in FIGURE 2(*b*) when contact finger assembly **32** is in a lower position **60**, the three fingers **35** on a common connection shown at the left-hand side are in contact only with the contact members **52** and **53** in base **45**.

When the three fingers **35** are in the upper position **61** of assembly **32**, FIGURE 2(*a*), the fingers **35** are in contact with contact member **51** and contact member **52** in base **45**, but not with contact member **53**.

In this example, a single-pole double-throw combination is achieved for the three finger common contact grouping **35**.

Any number of contact combinations such as those designated **35** may be used in any combination of arrays. For example, if contacts **35** were a two-finger arrangement, or grouping, a single-pole single-throw operation is achieved. With a pair of three-finger groupings **35**, double-pole double-throw contact is possible, utilizing two groupings of fixed contact members **51, 52, 53**. A variety of other combinations of fingers and fixed contacts on the base **45** may be included. As the number of combinations in the array increases or decreases, so may the diameter of the array **32** and base **45**. By adjusting the relative lengths or positions of contacts **51, 52, 53** switching action may be made multipolar break-before-make or make-before-break or any other desired form.

Contact base **45** is supported on a header assembly **55** having a plurality of pins **56** depending therefrom. There will normally be as many pins **56** on header **55** as there are contact containing flutes, or grooves, in contact base **45**, and each pin will be electrically connected to one of the contacts in the flutes or grooves.

A socket receptacle **57**, FIGURE 4, is provided as a separate unit for mounting in a chassis or similar assembly to receive the pins **56** of header **55**.

The socket receptacle **57** may be of such configuration as to be insertable into printed circuit boards to make switches according to this invention capable of being assembled in arrays of such switches on plug-in printed circuit board assemblies. Receptacle **57** may also have contacts of the blade type so as to be easily connectable in wiring harness assemblies, or it may have terminal pins such as **58**, illustrated in FIGURES 3 and 4.

The operation of the switch according to the invention described herein can be seen to be as follows.

The insulative contact base **45** has fixed metallic contact elements **51**, **52**, **53** therein within flutes, or grooves, **47**, **48**, **49** thereof. By wire connections **59**, FIGURE 1, contacts **51**, **52**, **53** are connected to terminal pins **56** in header **55**.

The spring finger contact array **32** is movable over base **45**. The fingers **35** of array **32** are in the form of a circular comb. The contact fingers **35** in various contact combinations with the contact elements **51**, **52**, **53** of different lengths in the flutes **47**, **48**, **49** in base **45** make a set of connections in an upper position **61** and different connections in a lower position **60**. For example, in position **61** connection between contact elements **51** and **52** is completed through fingers **35**. In position **60**, connection between contact elements **52** and **53** is completed through fingers **35**.

Spring finger contact array **32** is held in a normally upward position **61** by spring **42** interposed between the bottom **41** of eyelet **37** of assembly **32** and base **45**, see FIGURE 5. When the angular position of cam **50** is such that guides **21** are in slots **65** of the cam, array **32** is held in upper position **61**.

Momentary contact operation can be achieved by the omission of elements **28**, **31** and **50**, permitting plunger **22** to drive assembly **32** directly up and down with respect to base **45**.

In FIGURES 3 and 5, there is shown a detail view, in partial cross section, of the lamp-operatnig portion of the pushbutton switch according to this invention.

The contact base **45**, as described above, is insulative and fixed in the assembly of the switch. A central bore is provided therein at **44** in which the spring **43** is placed. Upon spring **43** the head or flange **81** of a pin **73** is seated. Guide pin **24** is hollow and an insulative sleeve **70** is inserted into the pin **24** so as to insulate pin **24** from elements in the interior thereof. Sleeve **70** has a flange **69** which separates and insulates the bottom **80** of guide pin **24** from the flange **81** of pin **73** within insulative sleeve **70**. Lamp circuit spring **72** separates a contact pin **71** having an enlarged end portion **83** from pin **73** and urges pin **71** upwardly away from **73**. Spring **72** provides electrical continuity between pins **71** and **73**.

As may be seen in FIGURE 5, lamp **74**, which has a base or shell **75** and center contact **76** separated from base **75** by insulator **77**, is inserted in a retainer **78** and held in place thereby. Within sleeve **23** of plunger **22**, lamp retainer **78** is provided with resilient extensions **69** that engage notches such as **62** in plunger cup **23**. The pushbutton cover **100** is engaged by retainer **78** also.

Center lamp terminal **76** makes contact through pin **71**, **83**, spring **72**, pin **73** and spring **43** with terminal pin **85** in base **45**. The shell terminal **75** of lamp **74** is in electrical contact with plunger cup **23**, which in turn is in contact with spring **31** through cam actuator **28** and eyelet **37** which by its flange **41** through outer spring **42** completes the electrical circuit to terminal pin **84**. Regarding this description of the lamp circuit, it will be noted that the insulating sleeve **70** with its flange **69**, which separates plunger **24** from pins **71** and **73**, though shown in FIGURE 3, has been omitted from FIGURE 5. This has been done for the sake of clarity of the drawing and it must be borne in mind that the elements **71**, **83**, **72**, **73** and **81**, is accommodated in, or shown in contact with plunger **24** are in reality electrically insulated therefrom.

In other embodiments of the invention, lamp circuit terminals **84**, **85** may be connected through some of the pin terminals **56** to external power connections so as to be energized upon the occurrence of one or the other of the positions of contact array **32** (position **60** or **61**) to complete the power circuit to lamp **74**, lighting the lamp for the desired indicating function. The circuit arrangements may include a break in the lamp circuit wherein pin **24** can be made to move to close the circuit at center contact **76** so that lamp **74** lights only when pressure is applied to pushbutton **100**.

What is claimed is:

1. An electrical switch comprising:

a base member having a plurality of longitudinally extending parallel grooves;

a plurality of electrical contact elements disposed in said grooves, at least one of said contacts electrically insulated from the others and at least one of said insulated contacts extending over less than the full length of said grooves;

an array of spring finger electrical contact elements having a plurality of fingers positioned in the grooves of said base member and longitudinally movable therein for making electrical contact with selected ones of said plurality of contact elements in predetermined longitudinal positions of said fingers with respect to said grooves.

2. An electrical switch as claimed in claim **1** wherein said base member is insulative.

3. An electrical switch as claimed in claim **1** wherein said base member is cylindrical.

4. An electrical switch as claimed in claim **3** wherein said grooves extend axially of said base member and are disposed about its periphery.

5. An electrical switch as claimed in claim **1** wherein said base member is an insulative cylinder.

6. An electrical switch as in claim **1** wherein the electrical contact elements disposed in said grooves are of various lengths.

7. An electrical switch as in claim **1** wherein the electrical contact elements disposed in said grooves are at various longitudinal locations with respect to said base member.

8. An electrical switch as claimed in claim **1** and further comprising means for moving said array between first and second predetermined longitudinal positions with respect to said base member.

9. An electrical switch as claimed in claim **1** wherein selected ones of said spring finger contact elements are electrcially interconnected.

10. An electrical switch as claimed in claim **4** wherein said array of spring finger contact elements is cylindrical and is coaxial with said base and axially movable with respect thereto.

11. An electrical switch as claimed in claim **1** wherein said base member comprises a terminal connection header having a plurality of terminal pins therein, particular ones of the contact elements in said grooves electrically connected to particular one of said terminal pins.

12. An electrical switch as claimed in claim **8** wherein said means for moving said array comprises pushbutton means, a rotary cam mounted for axial motion along its axis of rotation and engaging said array, means engaging said pushbutton means and engageable with said rotary cam for actuating said cam to axial and rotational

motion, the axial motion of said cam producing a corresponding longitudinal motion of said spring finger contact elements in said grooves.

13. An electrical switch as claimed in claim 12 and including means for locking said rotary cam in first and second axial stations corresponding to said first and second longitudinal positions when said cam is in first and second rotary positions respectively with respect to said pushbutton engaging means.

14. A pushbutton switch comprising:

a fixed cylindrical array of contacts;

a movable switching means having an array of dependent spring finger contacts mounted for axial movement to first and second axial positions with respect to said fixed array, different sets of contacts of said fixed and movable arrays in electrical contact in said first and second axial positions, selected contacts of said movable array electrically interconnected to provide predetermined connections between contacts of said fixed array in said first and second axial positions;

pushbutton means; and

rotary cam means engaging said pushbutton means and including means engaging said movable switching means and adapted to selectively position said spring finger contacts in said first and second axial positions upon successive operations of said pushbutton means.

15. An electrical switch as claimed in claim 14 and further including terminal connection header means having a plurality of terminal pins therein, particular ones of the contacts of said fixed array electrically connected to particular ones of said terminal pins.

References Cited

UNITED STATES PATENTS

2,162,528	6/1939	Curtiss	200—16
3,219,781	11/1965	Miller et al.	335—126

ROBERT K. SCHAEFER, *Primary Examiner.*

H. O. JONES, *Assistant Examiner.*