

[54] **MULTIPLE POSITION SLIDE SWITCH ASSEMBLY WITH AUXILIARY SWITCH DEACTIVATED BY CONTROLLER IN EXTREME POSITION**

[75] Inventor: **Joseph L. Lockard**, Harrisburg, Pa.
[73] Assignee: **AMP Incorporated**, Harrisburg, Pa.
[22] Filed: **May 7, 1973**
[21] Appl. No.: **357,980**

Related U.S. Application Data

[63] Continuation of Ser. No. 257,584, May 30, 1972, abandoned.

[52] U.S. Cl. **200/16 D, 200/164 R**
[51] Int. Cl. **H01h 15/08**
[58] Field of Search.. **200/16 R, 16 C, 16 D, 166 R, 200/166 B, 164 R**

References Cited

UNITED STATES PATENTS

3,757,060 9/1973 Ianuzzi et al. 200/16 C

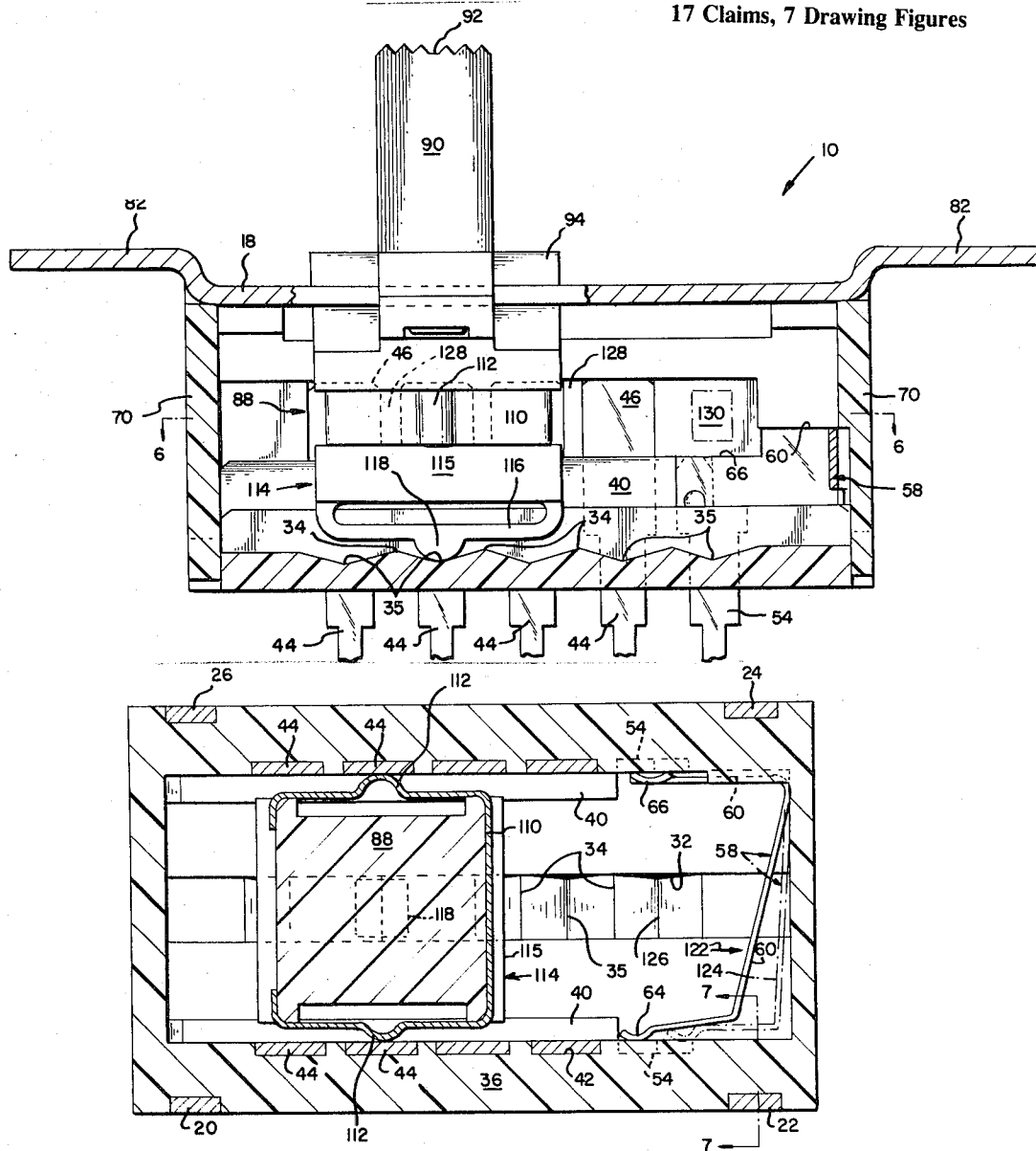
Primary Examiner—James R. Scott
Attorney, Agent, or Firm—Gerald K. Kita

[57]

ABSTRACT

A multiple position slide switch is disclosed which is particularly suitable for use with miniature calculators and similar types of compact electronic equipment. The slide switch includes a housing which protects its contact structure from large dirt particles, small metal articles and other spurious items which might normally fall into the contact structure of a slide switch. The switch provides a unique contact arrangement including a plurality of normally open contacts which are selectively closed by the appropriate positioning of a manually slidable connector element. An additional pair of contacts are also provided which are normally closed by a resilient connector element. However, the slide switch is constructed so that all contacts may be opened by appropriate positioning of the manually slidable connector element. A precise detent assembly is provided to maintain the manually slidable connector element in selected positions.

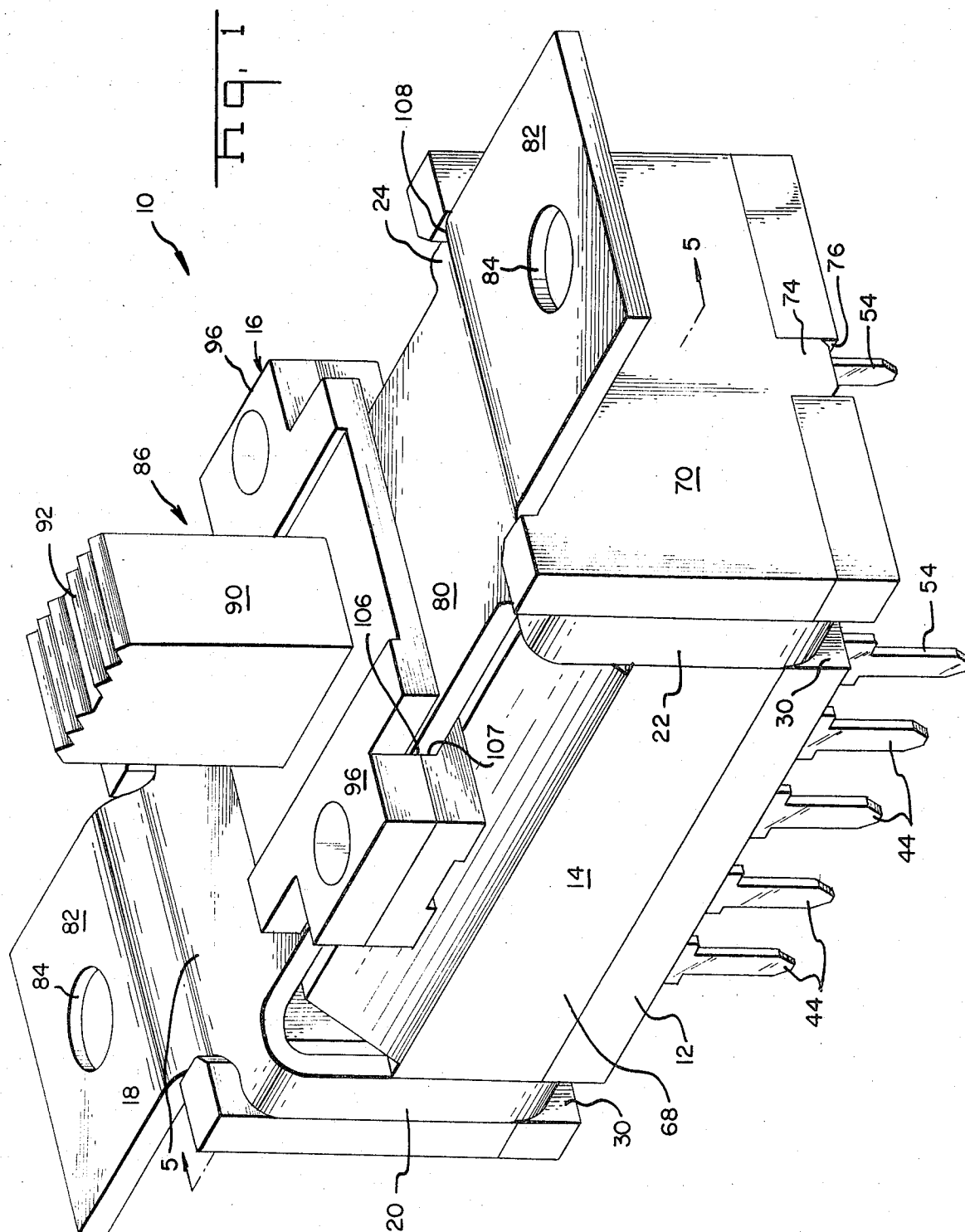
17 Claims, 7 Drawing Figures

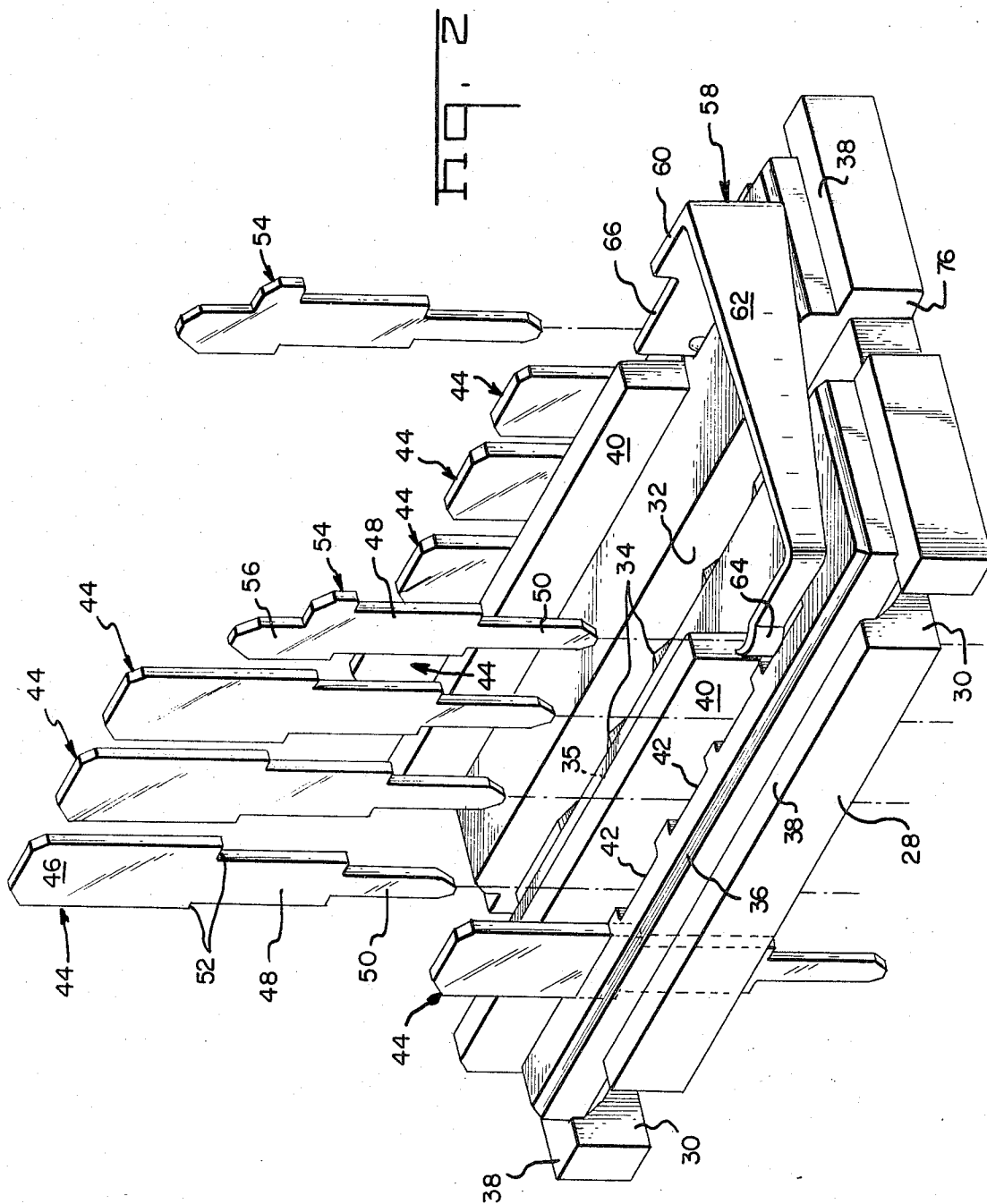


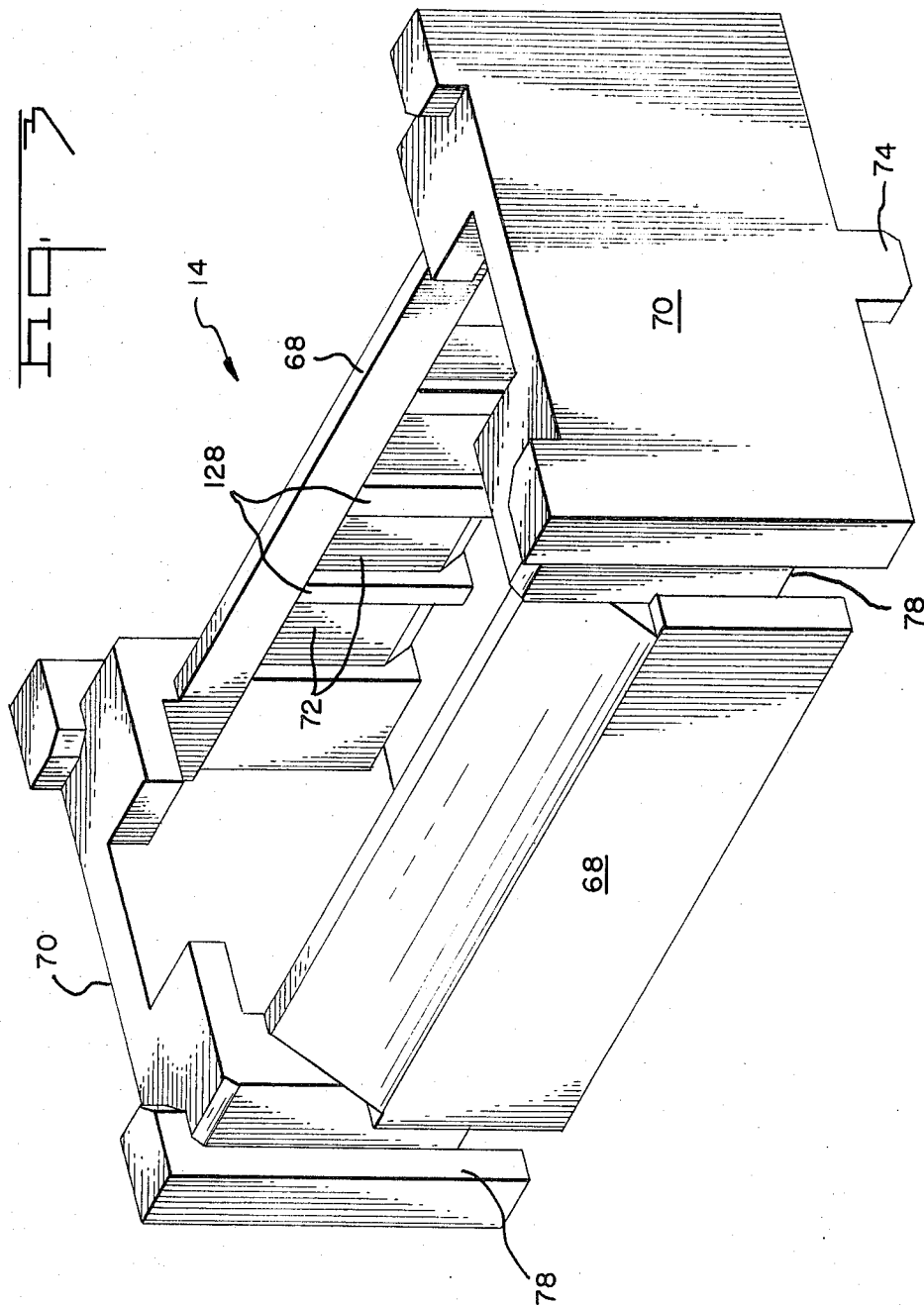
PATENTED OCT 22 1974

SHEET 1 OF 6

3.843,852



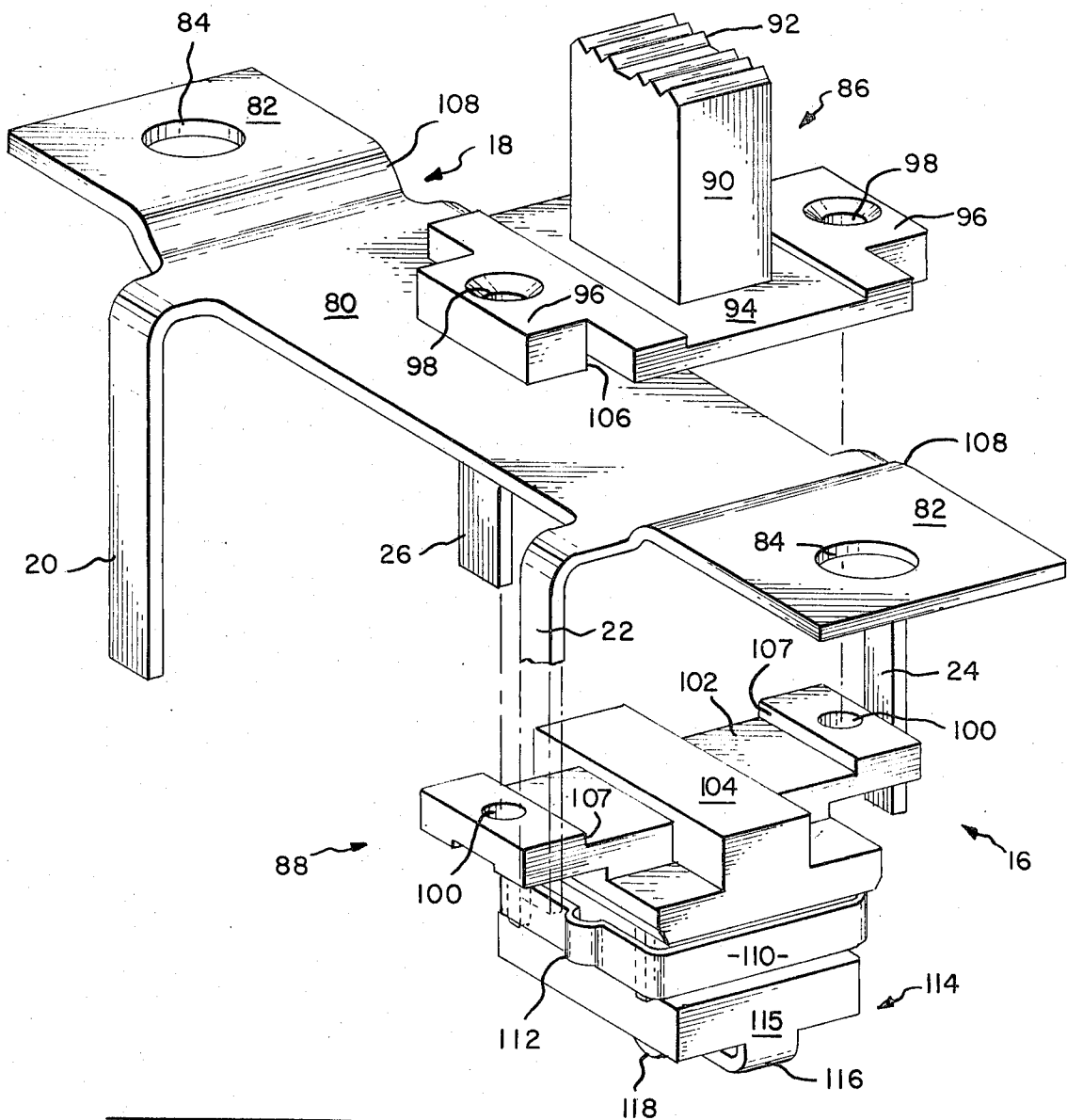




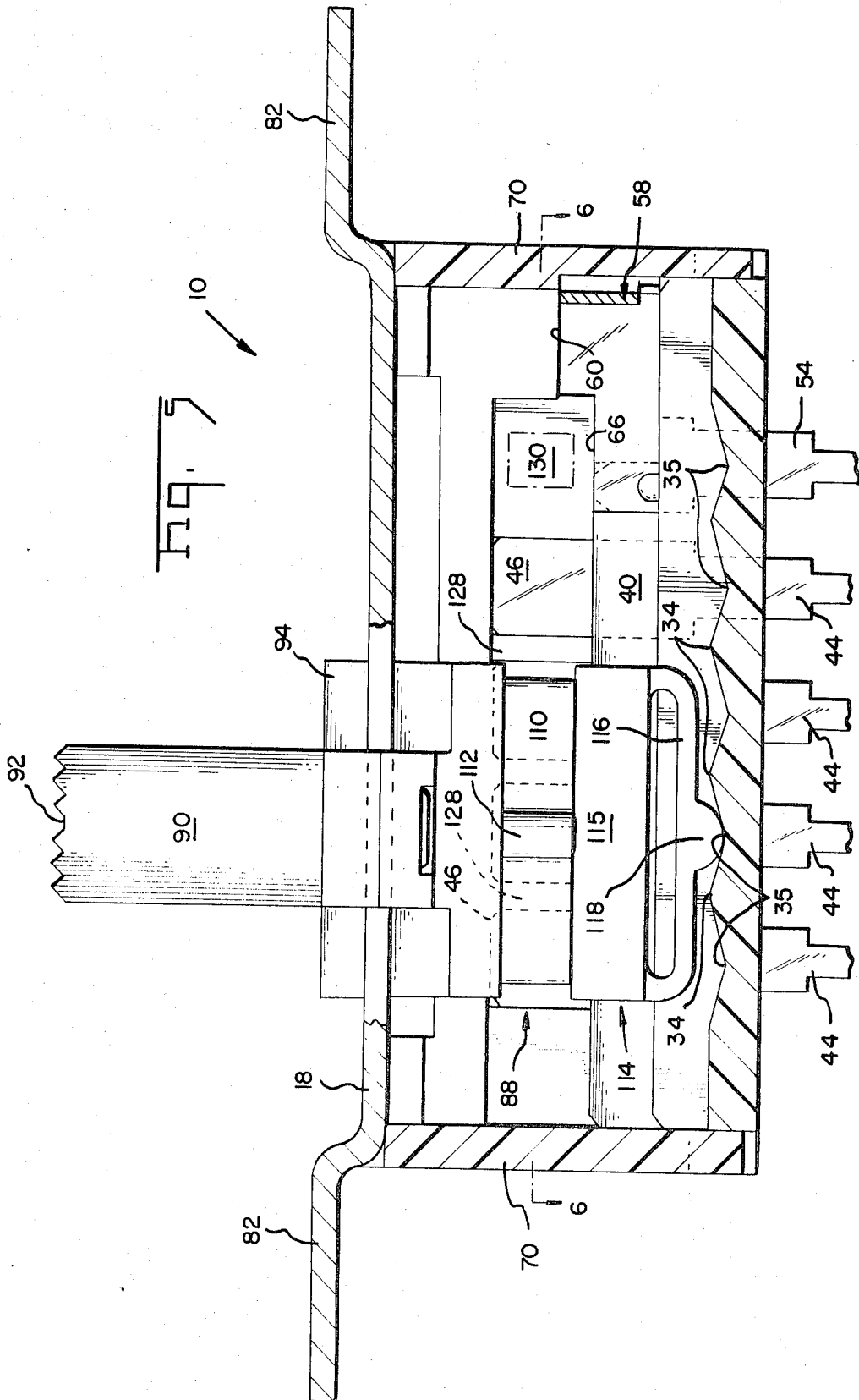
PATENTED OCT 22 1974

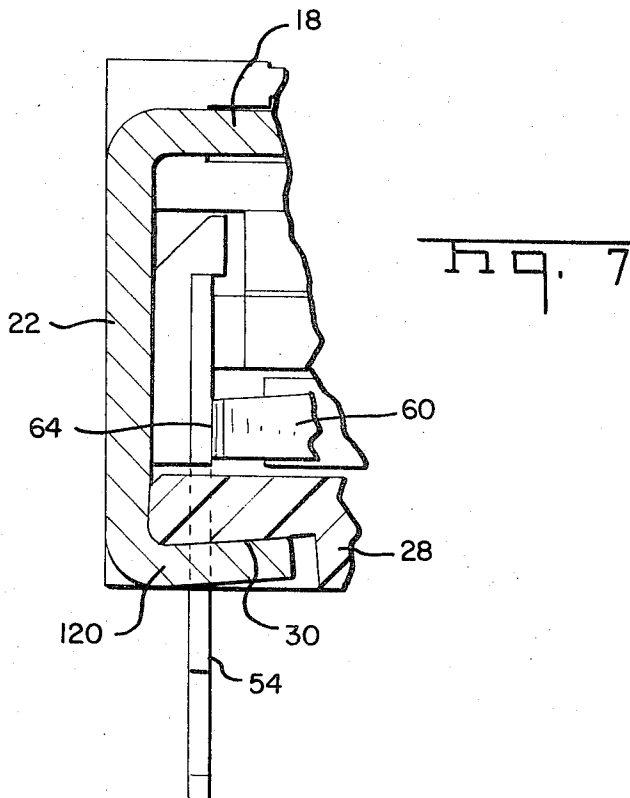
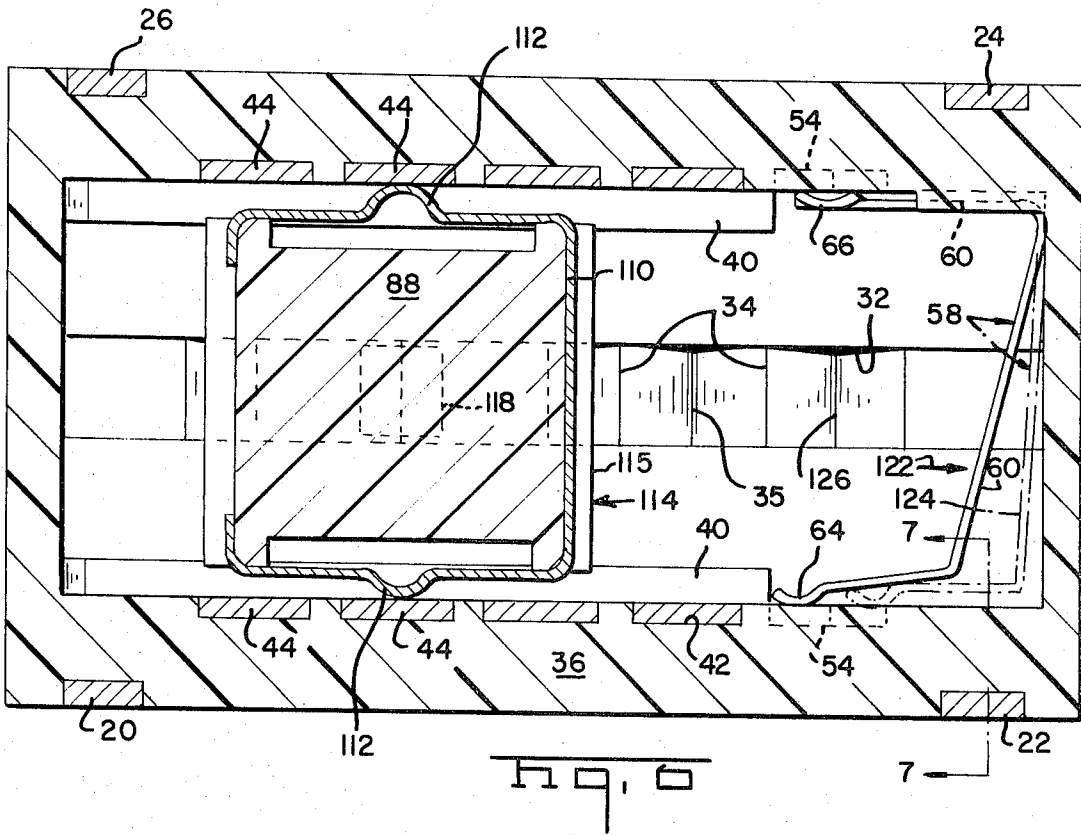
3.843,852

SHEET 4 OF 6



4





MULTIPLE POSITION SLIDE SWITCH ASSEMBLY WITH AUXILIARY SWITCH DEACTIVATED BY CONTROLLER IN EXTREME POSITION

This is a streamlined continuation of application Ser. No. 257,584, filed May 30, 1972, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention:

This invention relates generally to slide switches, and more particularly to a multiple position slide switch including a first plurality of normally open contacts and a second plurality of normally closed contacts.

2. Description of the Prior Art:

The current dramatic expansion in the development of extremely compact and miniature electronics has created a need for an entirely new series of manually operable switching devices. For example, in many of the small calculators now available, a memory chip is included which requires a continuous supply of voltage to retain information. Thus, it is normally desirable to maintain a supply of voltage to the memory chip while calculations are being performed, although it will occasionally be desirable to cut off power to the memory chip, thereby erasing the information stored therein. Similarly, while calculations are being performed, it is often desirable to switch a decimal point among various locations, or to select a floating decimal position. All of these functions can be accomplished by a single switch, provided the single switch includes at least one pair of normally closed contacts for supplying power to the memory chip, and a plurality of normally open contacts for permitting alternative selection of the various decimal locations. Unfortunately, no suitable switch for performing all of these functions in the environment of a small electronic calculator or similar device has been developed prior to this time.

In addition to lacking the operational functions described above, switches available in the past have been susceptible to short circuiting and mechanical jamming due to the likelihood of large dirt particles and small metallic objects falling into them. This problem is particularly acute in the environment of miniature calculators and the like, which are often carried in shirt or coat pockets. When being carried in a pocket, it is very likely that paper clips, coins, and various types of dirt particles may fall into the calculator and become lodged in one or more of its controlling switches. Thus, these simple metal objects and dirt particles can jam or short circuit a functionally important switch, rendering a very expensive piece of electronic hardware inoperative. Thus, there is a need for a small switch, suitable for use with miniature electronic equipment, which includes a housing that protects the switch contacts and the switch mechanism from dirt particles and objects which tend to jam the mechanical mechanism of the switch, or electrically short circuit its contacts.

In addition to possessing the shortcomings pointed out above, miniature slide switches for use with the new generation of compact electronic equipment have often lacked a truly reliable and positive detent mechanism. The detent mechanism in a very small multiple position slide switch is, of course, extremely critical since the detent positions are separated by only short distances. Since the precise selection of a particularly detent position often determines the mode of operation of an electronic calculator or equivalent device, it is

very important to have a precise and positive detent mechanism in any slide switch used with such devices. For instance, in the example cited hereinabove of a miniature calculator including a memory chip, the result of a lengthy calculation may be stored in the memory chip. However, the slide switch used with the miniature calculator may include one detent position which cuts off power to the memory chip, causing erasure of the information stored therein. If the detent mechanism of the slide switch is not sufficiently positive and precise, an operator may inadvertently cause erasure of the memory chip, resulting in a loss of valuable information. Accordingly, there is a need for a novel type of miniature slide switch having a positive, precise and reliable detent mechanism.

SUMMARY OF THE INVENTION

Accordingly, one object of this invention is to provide a novel multiple position slide switch structure.

Another object of this invention is to provide a novel multiple position slide switch for controlling a plurality of normally open circuits and at least one normally closed circuit.

Yet another object of this invention is to provide a novel manually operated, multiple position slide switch having a protective housing for preventing foreign objects and dirt particles from entering the switch mechanism or fouling the switch contacts.

A still further object of this invention is the provision of a novel multiple position miniature slide switch suitable for use with miniature electronic equipment.

Yet another object of this invention is to provide a novel multiple position slide switch having a positive, precise and reliable detent mechanism.

Another object of this invention is to provide a novel multiple position slide selector switch including a first plurality of normally open contacts and a second plurality of normally closed contacts.

Briefly, these and other objects of the invention are achieved by providing a miniature switch structure having a sliding carriage carrying a conductive member which may selectively close any of a plurality of normally open contact pairs. The sliding carriage may also be used to selectively open a pair of contacts which is normally closed by means of a resilient connecting member. The switch includes a housing and a frame member which together form a shield for preventing foreign objects from entering the switch mechanism or fouling the switch contacts. The sliding carriage includes a resilient detent member which provides a positive, precise and reliable detent action.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

FIG. 1 is a perspective illustration of the slide switch structure of the present invention;

FIG. 2 is a perspective illustration of the contact mounting block used in the switch structure of FIG. 1;

FIG. 3 is a perspective illustration of a protective housing designed to be placed over the contact mounting block illustrated in FIG. 2;

FIG. 4 is an exploded perspective illustration of the connector carriage and upper frame member of the slide switch illustrated in FIG. 1;

FIG. 5 is a cut-away side view of the slide selector switch of the present invention taken along the line 5—5 of FIG. 1;

FIG. 6 is a cut-away plan view of the slide selector switch of the present invention taken along the line 6—6 of FIG. 5; and,

FIG. 7 is a fragmentary cut-away end view of the slide selector switch of the present invention taken along the line 7—7 of FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, wherein like reference numerals designate identical or corresponding parts throughout the several views, and more particularly to FIG. 1 thereof, the multiple position slide switch of the present invention is designated generally by the numeral 10, and is shown many times actual size. The slide selector switch 10 includes a contact mounting block 12 over which a protective housing 14 is mounted. A slidable connector carriage 16 is movably mounted on a frame 18, which both supports the connector carriage and encloses an open top portion of the protective housing 14. The frame 18 includes integral depending leg portions 20, 22, 24 and 26 positioned at each corner thereof. The depending leg portions 18—26 are wrapped around the protective housing 14 and the contact mounting block 12 to hold the major components of the switch assembly 10 together, as will be described in greater detail hereinafter.

Referring now to FIG. 2, the structure of the contact mounting block 12 is illustrated in greater detail. The contact mounting block 12, which is preferably constructed of a suitable dielectric material, such as a conventional plastic, includes a bottom panel 28 which includes lateral grooves 30 positioned in the lower surface thereof near each corner. Each lateral groove is adapted to receive a bent portion of one of the frame legs 20—26, as is shown in greater detail in FIG. 7. A longitudinal channel 32 is provided along the center line of the bottom panel 28. Along the bottom surface of the longitudinal channel 34 are provided a plurality of regularly spaced peaks 34 separated by valleys, or positive detent positions 35.

A contact support member 36, which may be formed integral with the bottom panel 28, forms an upper surface of the contact mounting block 12. A supporting ridge 38 surrounds the outer periphery of the contact support member 36 and forms a supporting surface for the protective housing 14 in the assembled slide selector switch 10. A pair of rails 40 are positioned on the upper surface of the contact support member 36, and are laterally spaced from the longitudinal channel 32. The rails 40, which may be formed integral with the contact support member 36, serve to partially support the connector carriage 16 in its sliding motion. A plurality of contact mounting apertures 42 are formed in the contact support member 36 between the outer periphery thereof and the outer surfaces of the rails 40. The contact mounting apertures 42 penetrate through the entire contact mounting block 12, and have an interior configuration which conforms to the shape of the contacts to be mounted in them. There are preferably ten contact mounting apertures 42 arranged in five

pairs along the length of the contact mounting block 12. However, it will be apparent to those skilled in the art that essentially any number of contact mounting apertures 42 may be provided.

A plurality of conventional contacts 44 are positioned in all but two of the contact mounting apertures 42. Each of the conventional contacts 44 includes an enlarged upper portion 46, which serves as a contact in cooperation with the sliding connector carriage 16, a reduced central portion 48 which is primarily enclosed inside one of the contact mounting apertures 42, and a terminal portion 50 which is of further reduced cross-sectional configuration. The terminal portion 50 provides a means for connecting electrical leads to the slide switch 12. Each of the conventional contacts 44 is preferably inserted into one of the contact mounting apertures 42 until a pair of shoulders 52 formed between the upper and central portions 46 and 48 of each of the conventional contacts 44 cooperates with a similarly configured ledge (not shown) within each of the contact mounting apertures 42 to prevent the conventional contacts 44 from sliding entirely through the contact mounting block 12. The enlarged upper portion 46 of each of the conventional contacts 44 is designed to extend above each of the rails 40 when the conventional contacts 44 are firmly positioned within the contact mounting apertures 42. As shown in FIG. 2, eight conventional contacts 44 are preferably provided, arranged in four pairs. However, it will be immediately apparent to those skilled in the art that essentially any number of such contacts may be used with the slide switch of the present invention. Location of the contacts, in pairs, corresponds to the contact spacings of the conventional Dual-In-Line Package (DIP). This allows pluggability of the contacts 44 into a conventional printed circuit board accepting DIP components.

A pair of shortened contacts 54 are also provided, and are preferably positioned in a pair of contact mounting apertures 42 located near one end of the contact mounting block 12. The contact mounting aperture 42, wherein the shortened contacts 54 are positioned, are located at a point in the contact support member 36 just beyond the end of the rails 40. The shortened contacts 54 include terminal portions 50 and central portions 48 which are identical to those of the conventional contacts 44. However, the shortened contacts 54 include upper portions 56 which are substantially shorter than those of the conventional contacts 44. Accordingly, the upper portions 56 of the shortened contacts 54 do not extend above the top portions of the rails 40.

A resilient connector 58, which is preferably formed of a metal or alloy that is both highly conductive and highly resilient, and which includes a base portion 60 and a movable arm portion 62, is secured to the contact mounting block 12. The base portion 60 of the resilient connector 58 is immovably secured to a portion of the contact support member 36, while the movable arm portion 62 is secured only to the base portion 60 of the resilient connector 58. A contact 64 is formed integral with the arm portion 62 of the resilient connector 58, and is adapted to normally engage one of the shortened contacts 54. Similarly, a contact 66 is formed on the base portion 60 of the resilient connector 58, and is adapted to permanently engage the other shortened contact 54.

Referring now to FIG. 3, the protective housing 14 is illustrated in greater detail. The protective housing 14 includes a pair of side walls 68 and a pair of end walls 70 which are designed to surround the periphery of the contact assembly illustrated in FIG. 2. The interior surface of each side wall 68 includes a plurality of recesses 72 which are configured to closely conform to the shape of the upper portions 46 of the conventional contacts 44. The end walls 70 include a depending locating tab 74 which is configured to interfit with a locating channel 76 formed in the bottom panel 28 of the contact mounting block 12, shown in FIG. 2. Thus, the protective housing 14 is designed to be positioned over the contact mounting block 12, with the locating tabs 74 of the protective housing 14 positioned within the locating channels 76 of the contact mounting block 12. Similarly, when the protective housing 14 is mounted on the contact mounting block 12, the lower peripheral surface of the housing 14 rests on the supporting ridge 38 of the contact mounting block 12, and the recesses 72 surround the upper portions 46 of the conventional contacts 44 and fixedly retains the contacts against the corresponding rails 40. A channel 78 is provided near each corner of the protective housing 14 to receive the frame legs 20-26 of the frame 18.

Referring now to FIG. 4, the frame 18 and the connector carriage 16 are shown in greater detail. More particularly, the frame 18 is shown as including a flat central portion 80 having a raised mounting flange 82 formed at either end thereof. Each mounting flange includes an aperture 84 adapted to receive a screw, bolt or other suitable fastening means for securing the slide selector switch 10 to a piece of electronic equipment or the like.

The connector carriage 16 is shown in exploded form as including an actuator assembly 86, and a sliding contact carrier assembly 88. The actuator assembly 86 includes a manually engagable button 90, having a knurled upper surface 92, secured to a mounting panel 94. The mounting panel 94 has substantially the same width as the flat central portion 80 of the frame 18, and is adapted to slide along the surface of the flat central portion 80. A pair of wings 96 are formed integral with the mounting panel 94, and extend beyond the width of the flat central portion 80 of the frame 18. A mounting aperture 98 is located in each of the wings 96, and is aligned with a similar mounting aperture 100 located in an upper portion 102 of the sliding contact carrier assembly 88. Suitable fastening means such as screws, bolts or rivets are preferably passed through the aligned mounting apertures 98 and 100 to secure the actuator assembly 86 to the sliding contact carrier assembly 88. When these two assemblies are secured together, a raised central portion 104 of the upper portion 102 of the sliding contact carrier assembly 88 abuts the lower surface of the flat central portion 80, and serves as a bearing for the sliding contact carrier assembly 88. Similarly, when the connector carriage 16 is assembled, aligning ridges 106 and 107, which are integral with the lower edges of wings 96 and with the upper portion 102 of the sliding contact carrier assembly, respectively, abut the opposite sides of the flat central portion 80 of the frame 18, and thereby maintain the connector carriage 16 in proper alignment with the frame 18. Once assembled, the connector carriage 16 is slidable along the flat central portion 80 of the frame 18. The motion of the connector carriage 60 along the flat central por-

tion 80 is limited by a pair of stop ridges 108 which also form the interconnection between the flat central portion 18 and the mounting flanges 82 of the frame 18.

A connector 110, which may be constructed of a suitable highly conductive metal, is mounted around the outer periphery of the sliding contact carrier assembly 88. Contact bulges 112 are formed on either side of the connector 110, and are adapted to selectively engage each of the conventional contacts 44 carried by the contact mounting block 12.

A detent lock assembly 114, which is preferably formed of a single body of resilient plastic material, is secured to the bottom of the sliding contact carrier assembly 88. The detent lock assembly 114 includes a frame block 115 having a resilient bridge member 116 extending across it. A locking bead 118 is formed at the center of the resilient bridge member 116.

In assembling the components described hereinabove, the protective housing 14 is first preferably positioned over the completed contact mounting block 12. The connector carriage 16 is then coupled to the frame 18 by securing the actuator assembly 86 to the sliding contact carrier assembly 88. The frame 18 is then positioned over the protective housing 14, such that the sliding contact carrier assembly is positioned inside the protective housing 14, the flat central portion 80 closes the open top of the protective housing 14, and the frame legs 20-26 are positioned in the channels 78 of the protective housing 14. The frame legs 20-26 are then bent inwardly, so that their end portions are positioned in the lateral grooves 30 of the contact mounting block 20. Thus, as shown in FIG. 7, a bent portion 120 of each of the frame legs 20-26 is securely positioned beneath the bottom panel 28 of the contact mounting block 12. Thus, the frame legs 20-26, once bent to fit within the lateral grooves 30, surround the principal structural components of the slide selector switch 10, retaining all of the components together in a single cohesive unit.

In the assembled switch, the resilient bridge member 116 of the detent lock assembly 114 rides in the longitudinal channel 32 of the contact mounting block 12, and the locking bead 118 cooperates with the peaks 34, and the valleys 35 therebetween to form a positive, precise multiple position detent defining a plurality of discrete slide switch positions. Similarly, the contact bulges 112 ride along the top of the rails 40 to selectively engage the enlarged upper portions 46 of each of the conventional contacts 44.

The operation of the slide selector switch 10 of the present invention is more clearly illustrated by reference to FIG. 6. As shown in FIG. 6, the contact bulges 112 of the connector 110 engage conventional contacts 44 positioned on opposite sides of the sliding contact carrier assembly 88. Thus, by moving the contact carrier assembly 88 along the longitudinal channel 32, different pairs of conventional contacts 44 may be interconnected by the connector 100. However, as also shown in FIG. 6, the shortened contacts 54 are normally connected by the resilient connector 58. As the sliding contact carrier assembly 88 is moved along the channel 32 toward the right side of the apparatus illustrated in FIG. 6, the front face of the detent lock assembly 114, which projects beyond the connector 110, will engage the resilient connector 58. Thus, as the sliding contact carrier assembly 88 is moved further to the

right, the resilient connector 58 is moved in the direction illustrated by an arrow 122 to a position illustrated by a dashed line 124. In this position, the contact 64 slides away from the shortened contact 54, with which it is normally engaged, thereby opening the circuit which normally exists between the two shortened contacts 54. However, when the sliding contact carrier assembly 88 reaches the final detent position, indicated by a reference numeral 126, the contact bulges 112 do not engage the shortened contacts 54, since as pointed out above, the shortened contacts 54 do not protrude above the rails 40 into the path traversed by the connector 110 and the contact bulges 112 forming a portion thereof. The cooperation between the various contacts and the connector 110 is also illustrated in FIG. 5. As shown in FIG. 5, the upper portions 46 of each of the conventional contacts 44 extend above the rail 40. A nonconductive rib 128 is positioned between each pair of conductive upper portions 46. The nonconductive rib 128 is illustrated more clearly in FIG. 3 as the raised portion which separates each of the recesses 72. In the assembled switch, the ribs 128 lie flush with the upper portion 46 of the various conventional contacts 44. Thus, each of the contact bulges 112 engages a substantially smooth surface comprised of alternating conductive and nonconductive segments as the sliding contact carrier assembly 88 is made to traverse the length of the slide selector switch 10. However, when the contact bulges 112 on the sliding contact carrier assembly 88 reach the position of the shortened contacts 54, they do not engage a conductive surface, but instead an insulating panel 130, which forms a portion of the contact mounting block 12.

Referring again to FIG. 6, the operation of the slide selector switch of the present invention will now be apparent. More particularly, as set forth above, the two shortened contacts 54 will normally be coupled by the resilient connector 58, and various pairs of conventional contacts 44 are coupled together by the connector 110, depending upon the position of the sliding contact carrier 88. However, as the sliding contact carrier 88 is moved to the right most position, as illustrated in FIG. 6, the resilient connector 58 is displaced to the position illustrated by the dashed line 124, breaking the electrical connection between the two shortened contacts 54. In addition, the contact bulges 112 will then be positioned adjacent insulating panels 130, as illustrated in FIG. 5. Accordingly, when the sliding contact carrier assembly 88 is in its right-most position, all contacts will be broken. Thus, the right-most position of the slide selector switch of the present invention may be used as an "off" position, in which all circuits passing through the switch are opened, while all other positions of the switch are positions in which at least two electrical circuits are completed through the switch.

Referring again to FIG. 5, the detent assembly of the slide selector switch of the present invention is shown in more detail. More particularly, the resilient bridge member 116 is shown as extending across the entire width of the frame block 115. As was pointed out hereinabove, the resilient bridge member 116 may be constructed of a conventional resilient plastic material, which will flex as the sliding contact carrier assembly 88 is moved among the plurality of valleys or stable detent positions 35, which are separated by the peaks 34. The locking bead 118 formed integral with the resilient

bridge member 116 interfits with each of the stable detent positions 35 to form a reliable, positive and accurate detent mechanism for retaining the sliding contact carrier assembly 88 in various discrete locations.

It will be clear to those skilled in the art that many more detent positions and many more contacts may be incorporated into the slide selector switch of the present invention, simply by duplicating the structure described hereinabove and extending the length of the switch.

Obviously, numerous additional modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein. ACCORDINGLY,

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A multiple position slide switch, comprising:

- a housing,
- a plurality of opposed pairs of electrical contacts mounted in spaced relationship in said housing and defining a space extending between each of the opposed pairs of said contacts,
- a first electrically conducting connector element mounted on said housing and normally engaging at least two of said contacts to define a normally completed first circuit path therebetween,
- the remaining contacts being maintained in spaced relationship to define a plurality of normally interrupted circuit paths,
- a cover covering said housing and enclosing upper portions of said contacts within said housing,
- lower portions of said contacts protruding externally of said housing for electrical connection externally of said housing,
- a carriage in said housing displaceable along said space extending between the opposed pairs of said contacts,
- a second electrically conducting connector element mounted on said carriage for displacement therewith, said carriage in a first position engaging said first connector element and thereby disengaging said first connector element from at least one of said two contacts to interrupt said first circuit path,

said carriage being displaceable along said defined space and thereby being disengageable from said first connector element to allow said first connector element to engage said two contacts and complete said first circuit path,

said carriage being displaceable for registration in turn in a plurality of positions along said defined space to engage said second connector element in turn with selected pairs of said remaining contacts to complete in turn said plurality of normally interrupted circuit paths.

2. The structure as recited in claim 1, and further including a base provided with a series of detents disposed along said defined space, and

said carriage having a resiliently flexible member provided with a projecting portion for registration in turn within the series of detents as said carriage is displaced in turn to said plurality of positions along said defined space.

3. The structure as recited in claim 1, and further including: a manually graspable button element mounted

on a base member which is slidable over the cover member and which extends outwardly of the cover member for connection to said carriage, said carriage having a portion thereof extending from said housing and outwardly of the cover member for connection to said button element. 5

4. A slide switch, comprising: a housing provided with a plurality of electrical contacts arranged in spaced pairs,

said housing enclosing a base portion of said switch 10 with the contacts protruding externally of said base portion for making electrical connections externally of said base portion,

an electrically conducting first connector element mounted in said housing and normally engaging a first spaced pair of said contacts to complete a first electrical circuit path therebetween, 15

a carriage mounted in said housing,

said carriage in a first position engaging said first connector element to disengage said first connector element from at least one of said contacts of said first pair of contacts to interrupt the first electrical circuit path, 20

said carriage having an electrically conducting second connector element thereon, 25

said carriage being displaceable in said housing from said first position to allow engagement of said first connector element with said first pair of contacts to complete said first circuit path, and

said carriage being further displaceable to a selected second position in said housing to engage said second connector element with an additional pair of said contacts to complete an additional circuit path between said additional pairs of said contacts, while said first connector element completes said first circuit path. 30 35

5. A slide switch, comprising: a housing containing a plurality of normally interrupted circuit paths defined by pairs of spaced electrical contacts, 40 an additional pair of spaced contacts in said housing,

an electrically conducting first connector element normally engaging said additional pair of contacts to define a normally completed additional electrical circuit path therebetween, 45

a carriage mounted for displacement in said housing and in a first stationary position engaging said first connector element and disengaging the same from said additional pairs of contacts to interrupt said additional circuit path, 50

said carriage being displaceable in said housing from said first position to allow said first connector element to engage said additional pair of contacts and complete said additional circuit path, 55

said carriage having an electrically conducting second connector element engageable with said pairs of spaced contacts to complete corresponding electrical circuits therebetween as said carriage is displaced to selected additional positions within said housing. 60

6. A slide switch, comprising: a housing, a plurality of circuit paths through said housing, each circuit path being interrupted by a discontinuous portion, 65 a carriage mounted for selective location in said housing and selectively locatable in a first position in a discontinuous portion of one of said circuit

paths, an electrically conducting first connector element mounted on said carriage and bridging across said discontinuous portion of said one of said circuit paths with said carriage in said first position to complete said one of said circuit paths,

an electrically conducting second connector element independent of said carriage and mounted to said housing, said second connector element engaging said another of said circuit paths and bridging across the discontinuous portion of another of said circuit paths for normally completing said another of said circuit paths in said housing,

said carriage when selectively located in a second position engaging said second connector element and retaining said second connector element disengaged from said another of said circuit paths to interrupt said another of said circuit paths.

7. The structure as recited in claim 6, wherein:

said first connector element is disengaged from said plurality of circuit paths when said carriage is located in said second position thereby interrupting all of said circuit paths in said housing.

8. In a slide switch having a base portion upon which is mounted at least one normally interrupted circuit path having a discontinuous portion, and a carriage having an electrically conducting first connector element mounted on said base portion for engagement with said normally interrupted circuit path and for bridging across the discontinuous portion thereof to complete said circuit path through said slide switch, the improvement comprising:

at least one additional circuit path mounted on said base portion and having an interrupted portion, an electrically conducting second connector element independent of said carriage and mounted on said base portion,

said second electrical connector element normally bridging across said interrupted portion of said additional circuit path to complete said additional circuit path through said switch,

said carriage being displaceable on said base into engagement on said second electrical contact and forcibly removing said second electrical contact from bridging across said interrupted portion of said additional circuit path, thereby interrupting said additional circuit path through said switch.

9. A slide switch, comprising: a housing, a plurality of first contacts mounted in said housing,

an electrically conducting first connector element mounted in said housing and normally engaging said first contacts to complete a first electrical circuit through said housing,

said first connector element being movable into a position disengaged from at least one of said first contacts to interrupt the first electrical circuit, a plurality of second electrical contacts mounted in said housing,

a carriage mounted for displacement in said housing,

an electrically conducting second connector element mounted on said carriage,

said carriage being displaceable in said housing to at least one selected position to engage said second connector element with a selected plurality of said second electrical contacts to establish at least one additional circuit path through said housing,

11

said carriage being further displaceable in said housing to at least another selected position to forcibly move and thereby disengage said first connector element from at least one of said first contacts to interrupt said first circuit path.

10. The structure as recited in claim 9, wherein, said carriage in said another selected position having the second connector element disengaged from said plurality of second contacts whereby the additional circuit path is interrupted.

11. The structure as recited in claim 9, wherein, said first contacts comprise a first pair of contacts, said second contacts comprise a plurality of additional pairs of contacts,

said carriage in said another selected position being between said first pair of contacts and forcibly disengaging said first connector element from at least one of said first contacts to interrupt said first circuit path,

said carriage being displaceable from said first position permitting said first connector element to engage said first contacts and complete said first circuit path,

said carriage being displaceable in turn between each pair of said additional contacts to establish a corresponding circuit path in turn between each pair of said additional contacts by connection of said second connector element in turn between each pair of said additional contacts.

12. The structure as recited in claim 11, and further including:

a cover portion of said switch enclosing all of said contacts within said housing,

said carriage having at least an extended portion thereof protruding outwardly from said housing and outwardly adjacent the cover portion,

a manually graspable button element displaceable over the surface of said cover portion externally of said housing,

said button element having a base portion extending outwardly of said cover portion for connection to said extended portion of said carriage, whereby displacement of said button element over the surface of said cover portion causes a corresponding displacement of said carriage in said housing.

13. The structure as recited in claim 9, and further including:

a cover portion of said switch enclosing all of said

12

contacts within said housing,

said carriage having at least an extended portion thereof protruding outwardly from said housing and outwardly adjacent the cover portion,

a manually graspable button element displaceable over the surface of said cover,

said button element having a base portion extending outwardly of said cover portion for connection to said extended portion of said carriage, whereby displacement of said button element over the surface of said cover portion causes a corresponding displacement of said carriage in said housing.

14. The structure as recited in claim 11, and further including:

a base portion enclosed by said housing and provided with a series of detents,

said carriage having a resilient member thereon,

a protruding portion on said resilient member engageable in turn with each of said series of detents as said switch is displaced in turn in between each pair of said additional pairs of contacts.

15. The structure as recited in claim 9, and further including:

a base portion enclosed by said housing,

said first and second contacts protruding from said base portion to provide electrical terminals for electrical connection externally of said base portion, said base portion being provided with a plurality of detents,

said carriage having a resilient member thereon, and a protruding portion on said resilient member engageable in turn within each of the plurality of detents as said carriage is displaced to selected positions.

16. The structure as recited in claim 9, wherein, said first connector element includes a metal resilient spring normally engaging said first contacts, said spring being resiliently deflected upon engagement thereof by said carriage to disengage said first connector element from at least one of said first contacts and thereby interrupt said first circuit path.

17. The structure as recited in claim 11, wherein, said first connector element includes a metal resilient spring normally engaging said first contact, said spring being resiliently deflected by said carriage to disengage said first connector element from at least one of said first contacts and thereby interrupt said first circuit path.

* * * * *

50

55

60

65