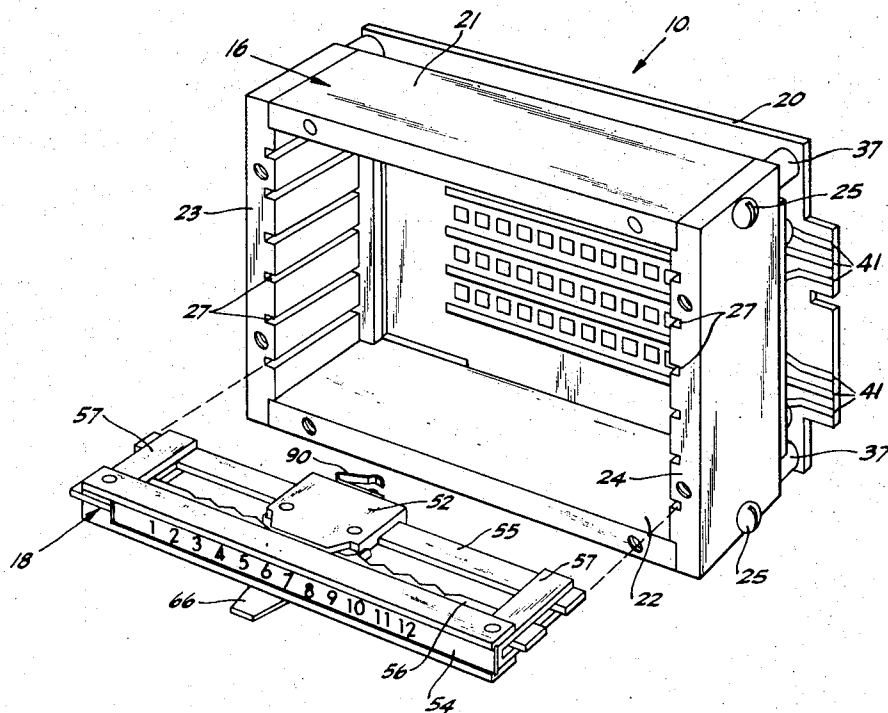


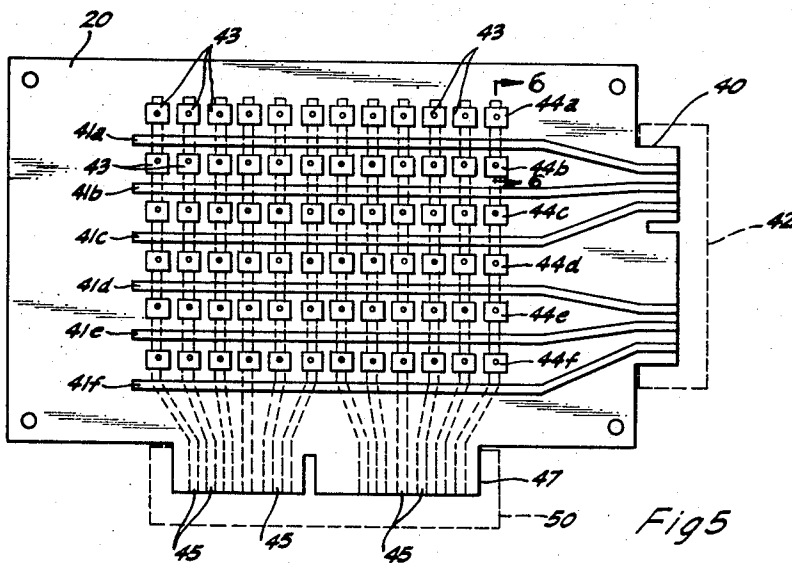
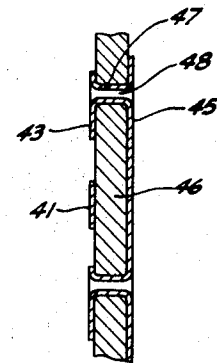
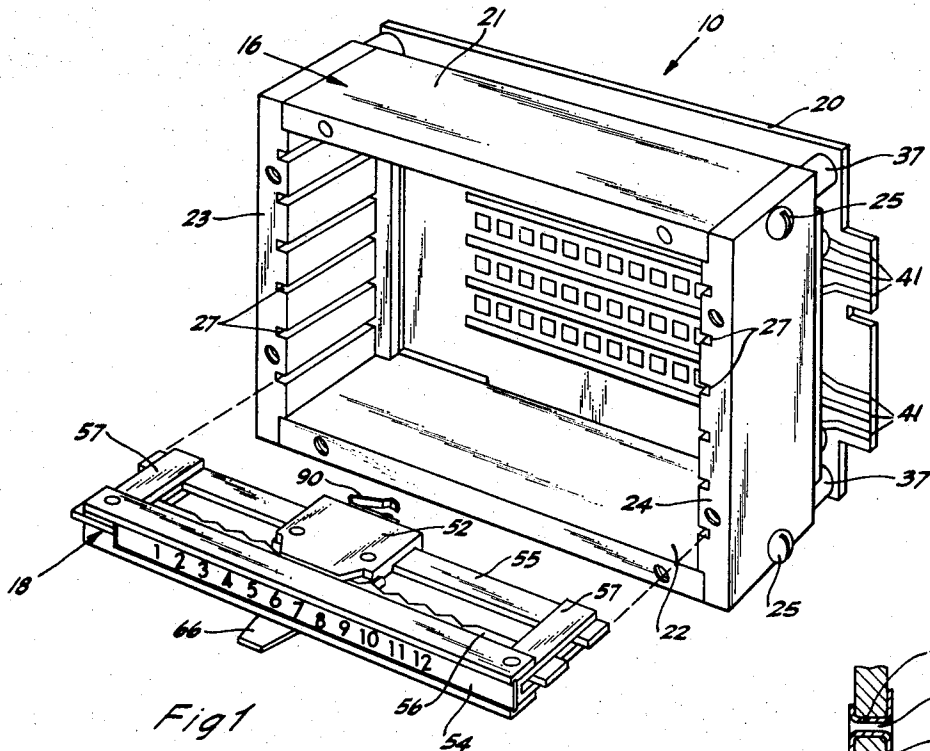
[54] **SLIDE SELECTOR SWITCH WITH  
MULTIPLE INDEPENDENTLY  
REMOVABLE SLIDE ASSEMBLY  
MODULES**[75] Inventor: **Carl William Rosmanith**, Des  
Plaines, Ill.[73] Assignee: **Beckman Instruments, Inc.**, Fuller-  
ton, Calif.[22] Filed: **Mar. 15, 1972**[21] Appl. No.: **234,812**[52] U.S. Cl. .... **200/16 R, 200/16 D, 200/17 R**[51] Int. Cl. .... **H01h 15/00, H02b 1/10**[58] Field of Search ..... **200/16 R, 16 C, 16 D,  
200/16 E, 17 R, 14, 168 K, 11 DA**[56] **References Cited****UNITED STATES PATENTS**

3,146,320	8/1964	Wang et al.	200/16 D X
3,335,298	8/1967	Craig	200/16 D X
2,971,066	2/1961	Tabet	200/14 X
3,308,250	3/1967	Field et al.	200/16 D
3,027,506	3/1962	Stenhammer et al.	200/16 D UX
3,205,319	9/1965	Anderson et al.	200/16 C
3,493,706	2/1970	Cherry et al.	200/16 D X
3,555,213	1/1971	Cherry et al.	200/17 R

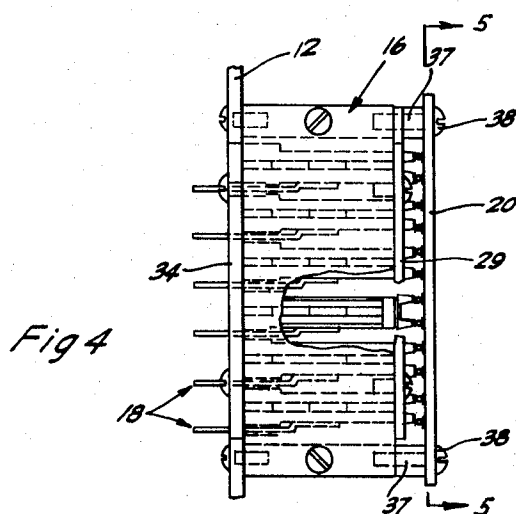
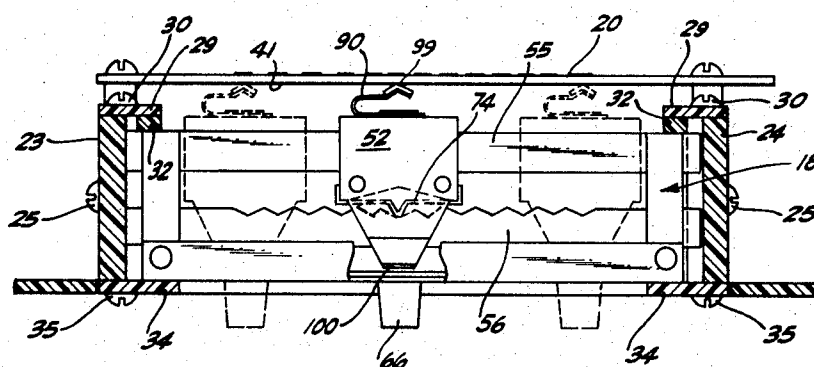
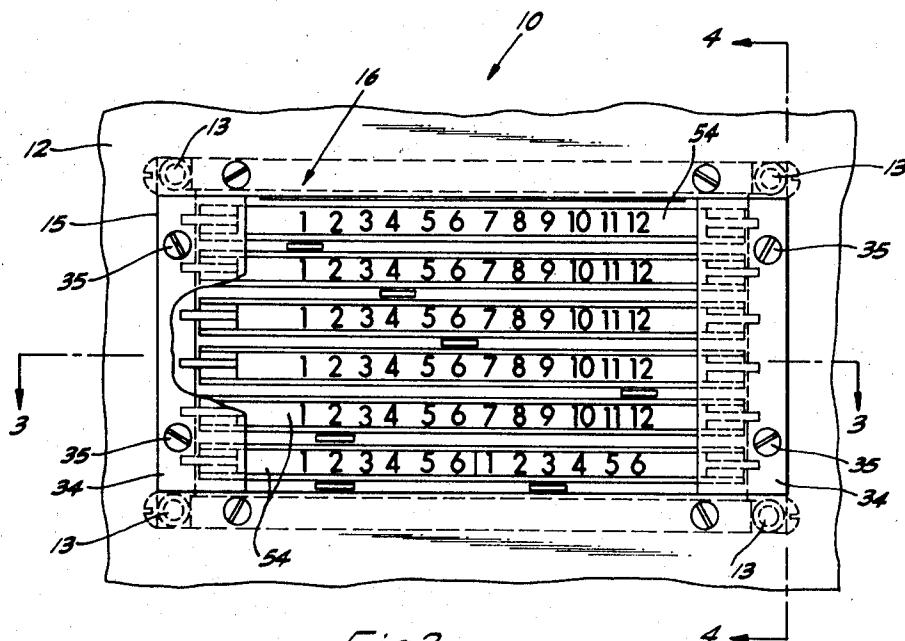
3,632,090 1/1972 Rowley ..... 200/16 D  
3,643,042 2/1972 Gratz ..... 200/16 D*Primary Examiner*—J. R. Scott*Attorney*—James M. Thomson and Robert J. Stein-  
meyer[57] **ABSTRACT**

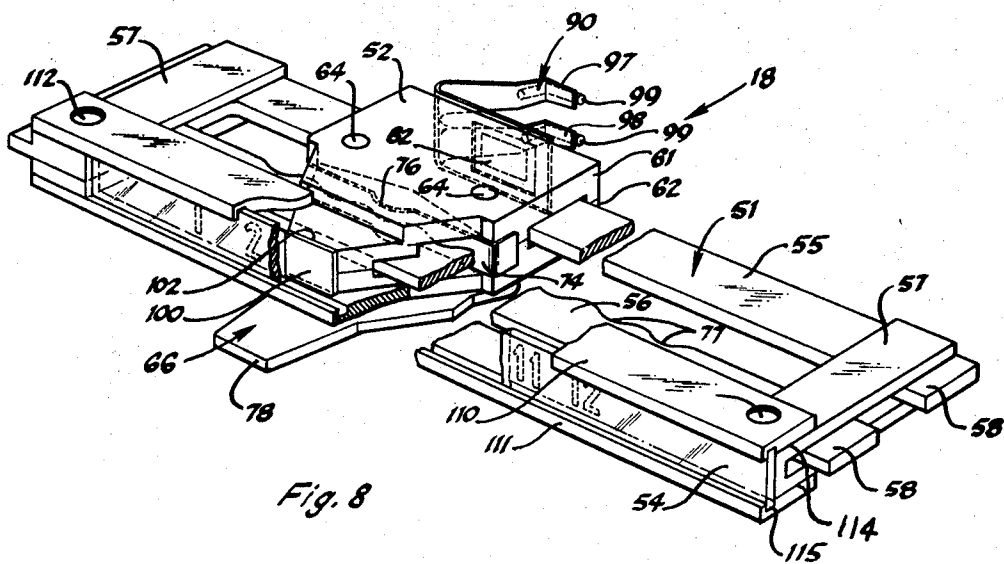
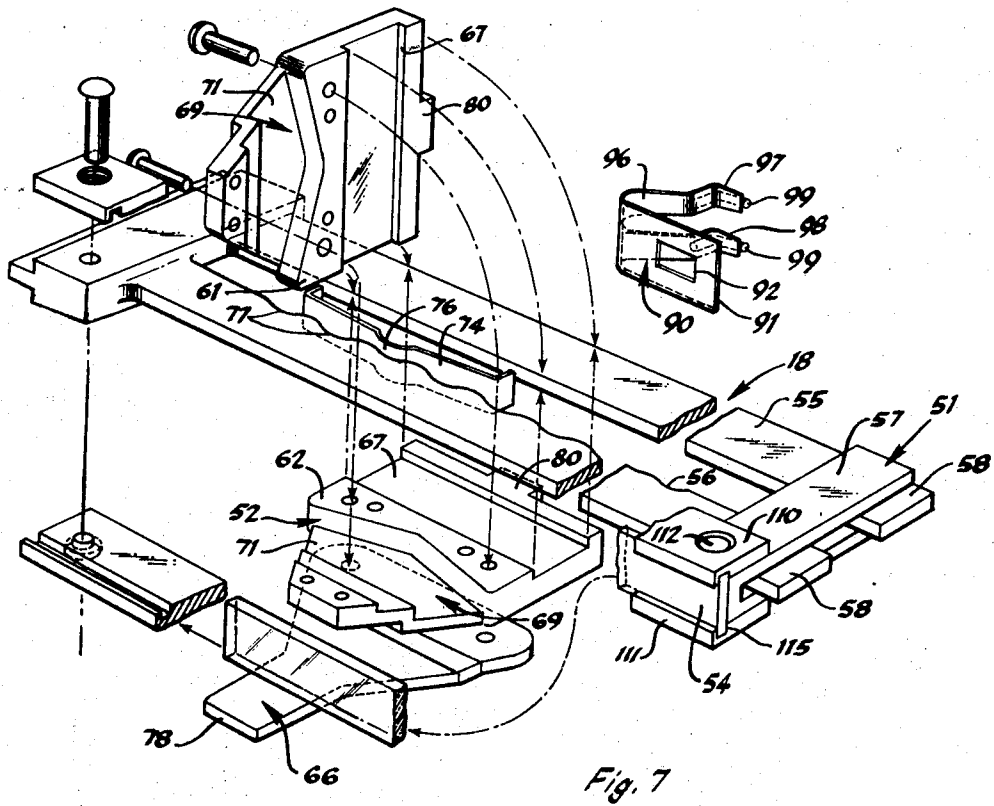
A slide selector switch including a plurality of independently removable slide assembly modules mounted within a housing, with each module having electrical contacts adapted to engage an etched printed circuit board at the rear of the housing. Each module includes a non-signal carrying slide supporting bar and at least one slide which supports the electrical contacts and is adapted for positive detenting to multiple switch positions along the bar. Each module is otherwise provided with a targeting arrangement which produces a highly visible display of an indicia associated with the selected switch position. The slide selector switch enables a high number of positive circuit selections to be made from a small panel area. Furthermore the slide assembly modules are readily removable from the switch housing for replacement, and such removal does not disturb the circuitry of the circuit board or wiring attached thereto, since the modules have no signal carrying member other than the electrical contacts.

**12 Claims, 8 Drawing Figures**



SHEET 2 OF 3





# SLIDE SELECTOR SWITCH WITH MULTIPLE INDEPENDENTLY REMOVABLE SLIDE ASSEMBLY MODULES

## BACKGROUND OF THE INVENTION

The present invention relates to a slide selector switch adapted for providing a high switching capacity from a small panel area. More particularly, the invention concerns a slide selector switch having a large number of independently removable slide assembly modules mounted within a housing, with each module having electrical contacts thereon adapted to engage a circuit board mounted at the rear of the housing.

Various slide selector switches are known in the prior art, directed toward the problem of attaining a high switching capacity from a relatively small panel area or within a small switch housing. Such switches are subject to certain disadvantages, since they are usually of intricate and complicated design. This results in high manufacturing cost and difficult maintenance since the parts of the switch often are not independently removable. Furthermore, due to the intricate design of such switches, it is usually not possible to remove or replace portions of the switch assembly without disturbing or interrupting the circuitry and wiring of the switch. Also other disadvantages often occur in the use of such slide selector switches, since the operator is not able to determine with ease and certainty the positions of the individual slides of the switches.

## OBJECTS OF THE INVENTION

Accordingly, it is an object of the invention to provide a slide selector switch suitable for horizontal or vertical mounting, which overcomes the disadvantages of prior art slide selector switches.

It is another object of the invention to provide a slide selector switch having one or more simplified, yet positive, circuit selections effected by contact springs, each carried on a slide of a slide assembly module, adapted to make contact with electrical circuit paths provided on a circuit board.

It is a further object of the invention to provide a slide selector switch including slide assembly modules that are readily and independently removable from the switch housing for replacement or repair without disturbing the electrical circuitry and wiring associated with the circuit board, or the other slide assembly modules.

It is yet another object of the invention to provide a switch of this character with no signal carrying members in its structure other than the circuit board and the movable contacts associated with each slide assembly module.

It is yet a further object of the invention to provide positive detenting means, associated with the slide of each slide assembly module.

It is still a further object of the invention to provide, in such a slide selector switch, individual indicia for each of the switch positions of a given module and special targeting means for providing a highly visible display of the indicia corresponding to the selected switch position.

## BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and features of the invention will become more apparent from the following detailed description of the invention taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a perspective view of the switch housing illustrating the manner in which a slide module assembly is inserted and withdrawn therefrom;

FIG. 2 is a plan view of the switch assembly mounted in a typical manner to a control panel;

FIG. 3 is a horizontal sectional view taken along line 3—3 of FIG. 2;

FIG. 4 is an end elevation view of the switch assembly taken substantially along line 4—4 of FIG. 2;

FIG. 5 is a plan view of the circuit board mounted at the rear of the switch housing, taken along line 5—5 of FIG. 4;

FIG. 6 is a fragmentary sectional view of the etched circuit board taken along line 6—6 of FIG. 5;

FIG. 7 is a perspective view, in exploded relation, showing the various parts that comprise a slide assembly module; and

FIG. 8 is a perspective view of a slide assembly module with portions broken away for purposes of illustration.

## DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings and particularly to FIGS. 1—4, one preferred embodiment of the invention is particularly illustrated comprising a slide selector switch 10 adapted to be mounted against a panel 12, such as an instrument panel, by means of screws 13, with the display face of the slide selector switch matching an opening 15 in the instrument panel as best seen in FIG. 2. The slide selector switch generally comprises a housing 16 within which a number of slide assembly modules 18 are independently and removably mounted, in a manner described hereinafter, and a circuit board 20 secured to the rear of the housing.

Housing 16 is of generally rectangular configuration including top and bottom members 21, 22 and side members 23, 24 joined together by screws 25. The front and rear of the housing are generally open. The side members are provided with pairs of opposed grooves or slots 27 formed on the inner sides thereof, adapted to receive surfaces of the slide assembly modules, in a manner described hereinafter in detail. Housing 16 can be fabricated from any suitable material such as sheet metal, bar stock or suitable plastic or insulating material. Although the housing is illustrated as comprising an assemblage of individual pieces, it could also be fabricated as a single molded or cast article.

Referring particularly to FIG. 3, slide assembly module retaining strips 29 are provided along the rear edges of side members 23, 24, being secured thereto by suitable means such as screws 30. Each of the rear retaining strips is provided, along its full length, with a resilient layer 32 of rubber or other suitable material. The resilient layer can be secured to the rear retaining strips in any suitable fashion, such as by an adhesive. The module retaining strips are preferably formed of metal or plastic. The strips are of sufficient width and are otherwise arranged such that the rear edges of the slide assembly modules 18 abut against resilient layer 32 on strips 29 when the modules are fully inserted into the switch housing.

As best shown in FIGS. 2 and 3, module retaining strips 34 are provided along the front edges of housing side members 23, 24, being removably retained in position by means of screws 35. Thus, with the housing installed on the instrument panel, module retaining strips 34 can be removed to permit easy insertion or withdrawal of any of the slide assembly modules. Such removal or replacement is readily effected without disturbing the switch housing or the other switch assembly modules.

Referring now to FIGS. 1 and 4, circuit board 20 is illustrated as being mounted in spaced relation to the rear of the switch housing by means of spacers 37 and screws 38 suitably secured through corresponding openings formed in the corners of the circuit board. Circuit board 20 is fabricated by conventional techniques, having a central core 46 of insulating material on either side of which are provided suitable conductive areas laid down by etching. The circuit board is provided on its front or inner face with a plurality of longitudinal electrical circuit paths 41a-41f spaced apart at predetermined intervals. Conductive paths 41 extend substantially across the face of the circuit board and converge and terminate at a connector block 40 formed on the right-hand side of the circuit board, as viewed in FIG. 5. Connector block 40 is adapted to receive a standard connector 42 such as that illustrated in dotted outline in FIG. 5.

A plurality of electrical contact areas or pads 43 are also provided on the front face of the circuit board, arranged in rows 44a-44f, interspersed with corresponding paths 41a-41f. The number of pads 43 in each row corresponds to the number of positions each slide of the assembly module is designed to provide. Thus, in the embodiment illustrated, each full length slide assembly module is adapted to have twelve switch positions.

As best shown in FIG. 5, the interspersed conductors are arranged so that a row 44 and a conductive path 41 are provided corresponding to each slide assembly module of the switch. Also, all the pads 43 occupying the number one position in each row are vertically aligned. Accordingly, each of the 12 vertical columns of pads 43 are juxtaposed with electrical circuit paths or strips 45 provided on the back surface of the circuit board. Circuit paths 45 are vertically oriented, as viewed in FIG. 5, and extend substantially the full depth of the circuit board, converging and terminating at the edge of a connector block 47 formed at the bottom of the circuit board. Connector block 47 is adapted to receive and make contact with a standard connector 50 such as that illustrated in dotted outline at the bottom of FIG. 5.

As best seen in FIG. 6, one or more holes 48 is formed through the core of the circuit board between each pad 43 and its corresponding conductive path 45. Conductive material or layers 47 are provided in these openings, for example deposited by a conventional process known as plating through, whereby electrical contact is made between all the pads of a given column and a corresponding conductive path 45. Therefore to complete a circuit between a selected conductive path 41 and a selected conductive path 45 it is merely necessary to bridge the gap between the appropriate pad 43 and the path 41. This function is achieved by slidable electrical spring contacts carried by a slide 52 on each slide assembly module 18.

Referring now to FIGS. 7 and 8, one slide assembly module 18 is particularly illustrated, comprising a module base 51, a slide 52 and a module indicia strip 54. The module base 51 is preferably formed of metal and the slide assembly is formed of insulating material. This gives good strength and shielding characteristics to the module base and minimizes the possibility that stray currents will reach the base. Base 51 includes a pair of spaced apart longitudinal bars 55, 56 joined near their extreme ends by cross members 57. The longitudinal bars and cross members are formed as a solid molding, stamping or casting, although the base could be fabricated of assembled members, if desired. The ends of the longitudinal bars project slightly beyond cross members 57 to form extensions 58 that have a thickness substantially corresponding to the depth of grooves 27. The longitudinal bars are of a suitable length such that extensions 58 of a given module are adapted to fit within any pair of oppositely disposed slots of the housing, for accurately positioning that slide assembly module within the housing. The rear edge of longitudinal bar 56 is serrated to form detenting pockets 77 to facilitate positioning of slide 52 in various switch positions in a manner described in detail hereinafter.

Still referring to FIGS. 7 and 8, slide 52 is formed of symmetrically molded upper and lower sections 61, 62 joined together by rivets 64 so as to encompass longitudinal bars 55, 56. An operating lever 66 is attached to the under side of lower section 62 of the slide, also by rivets 64.

Referring to FIG. 7, it is clear that sections 61, 62 are each formed with a rear recess 67 therein having a width substantially corresponding to the width of longitudinal member 55, and having a depth slightly greater than one half the thickness of longitudinal bar 55. Therefore, with the upper and lower sections of the slide sandwiched together around bar 55, the slide is smoothly and laterally movable with respect to the bar. In similar fashion, upper and lower sections 61, 62 are each formed with a recess 69 near the front thereof, adapted to surround front longitudinal bar 56 when the sections are sandwiched together.

Recesses 69 further include inner grooves 71 which are adapted to provide a housing for an elongate detent spring 74, when the sections are sandwiched together. Spring 74 has right angle bends formed at its extreme ends and is adapted to fit snugly over the opposite ends of the slide. The spring is otherwise formed with a protrusion 76 at the center thereof, adapted to seat within corresponding detenting pockets 77 of longitudinal bar 56.

As shown, one end 78 of the operating lever extends outwardly beyond the other portions of the slide assembly module so that it can be gripped by an operator for moving the slide laterally with respect to the module base. Upon such movement protrusion 76 of detent spring 74 is successively indexed along the longitudinal bar 56, successively dropping into the detenting pockets 77 formed therein. When the slide is stopped in a desired switch position the protrusion positively engages the corresponding detenting pocket and retains the slide in that desired position.

Protrusions 80 are provided at the rear edge of the upper and lower sections of the slide so that a contact mounting block 82 is formed when the sections are sandwiched together. A conductive, spring contact 90

is also provided having a base portion 91 with a rectangular opening 92 formed therein adapted to fit over the periphery of projection 82. The contact member is suitably retained upon projection 82. For example the contact can be adhered to the block by applying sufficient heat to the projection, where the upper and lower sections are formed of plastic, to cause the plastic to flow over and beyond the surfaces of the spring contacts surrounding the opening. In the event that the slide is fabricated of other material the spring contact could be secured thereto by adhesives or other suitable means.

The spring contact is provided with a bifurcated outer extension 96 forming two fingers 97, 98 bent at their extremities into V-shaped portions to which contacts 99 are secured. In the embodiment illustrated precious metal contacts are utilized and are secured to the fingers by welding. However it should be apparent that other types of electrical contacts could be utilized, if desired.

Contacts 99 are spaced apart a sufficient distance to engage, respectively, the conductive path 41 and the conductive pad 43 associated with a given module so that a bridging circuit is created between the respective conductive areas, as is best apparent from FIGS. 3 and 4. The contact fingers are adapted to rest against the conductive areas with light but positive force. Accordingly, transverse movement of the slide and contacts does not damage the conductive paths; yet the spring force of the contact fingers is sufficient to ensure satisfactory electrical contact with the conductive areas.

Referring again to FIG. 8, the front portion of the upper and lower sections of the slide are tapered and terminate at their extreme forward ends to form a vertical face 102 when joined, upon which a target 100 is adhesively secured. In the embodiment described, target 100 is formed of a rectangular section of bright fluorescent material for a purpose described hereinafter.

A pair of metal strips 110, 111 are secured, respectively, to the upper and lower surfaces of cross members 57, so as to extend longitudinally of the front of the slide assembly module. In the embodiment illustrated strips 110, 111 are secured by rivets 112, although other suitable fastening means could be utilized if desired. The inner surfaces 114 are formed with opposed longitudinal grooves 115 extending along their length, adapted to receive the edges of transparent plastic strip 54, which can be slidably inserted from one end of the assembled slide module. The strip is provided, on its rear face, with indicia printed thereon in an opaque color. In the embodiment illustrated the numerals 1-12 are provided, corresponding to the twelve switch positions. Since the numerals are opaque and the strip is clear the entire scale is easily visible. However as the slide is moved along the bars to a selected switch position, target 100 is moved behind a corresponding numeral or indicia thereby serving to cause that numeral to be highlighted so that it is highly visible.

Alternatively the strip could be formed of an opaque substance with clear or cut out numbers formed therein. With such a presentation, only the number selected by the target is easily visible and the rest of the strip looks opaque. Depending upon the nature of the indicia and the application for which the switch is to be used it may be advantageous not to be able to see the markings upon the entire switch.

The slide assembly module illustrated in FIGS. 7 and 8 is of singular configuration, i.e., having a single slide and twelve switch positions. However, the slide assembly modules can be of dual slide configuration such as the one illustrated in FIG. 2, i.e., having twelve switch positions and two slides. In that event, the slides are each capable of traversing only part of the switch positions, for example six, and are separated by suitable means, such as a rivet extending through the rear longitudinal bar of the module so that the two slides cannot be moved into interfering positions. It should be apparent that any combination of single or dual slide configuration modules could be utilized in building up a slide selector switch having a predetermined capability. Likewise a single module could be used, if desired.

In the operation of the slide selector switch described herein the operator is able to select combinations of switch positions which will effect the desired circuit connections for a particular purpose. The slide selector switch is particularly versatile since it provides an unusually high switching capacity in a small panel area, in conjunction with excellent visibility of the indicia selected by each switch slide. It has been found that an experienced operator setting particular instrument settings on a slide selector switch of the type described develops an ability to verify the correct settings for a particular test from the general shape or pattern developed by the various targets of the slide selector switch, without referring specifically to the numerals targeted. This serves as a valuable verification technique to double check for correct instrument settings.

The slide selector switch is otherwise advantageous since, by merely removing the retaining strips at the left end right edges of the display, one or more of the slide assembly modules can be removed and replaced if servicing is required without disturbing the other modules of the switch. Furthermore, such removal and replacement is effected without disturbing the electrical circuitry of the circuit board or of the connections thereto. Accordingly it enables servicing of the slide selector switch with minimal disassociation of the switch from its associated environment. The design of the switch in this regard is particularly advantageous in that the only signal carrying elements of the switch that are capable of being associated with the circuit board are the switch contacts themselves, since the remaining adjacent portions of the module are fabricated of non-conductive material.

It is also possible to use different indicia strips with the modules of the switch. This enables particular sets of indicia, as may be required for the control of various equipment associated with the switch, to be used on the switch. Consequently, the versatility of the switch is enhanced.

What is claimed is:

1. A slide selector switch term-assembly comprising a housing having at least one set of receiving means adapted to engage a plurality of slide assembly modules;
- a circuit board associated with said housing having a plurality of sets of conductive paths formed thereon; and
- at least one independently removable slide assembly module, including a non-signal carrying bar having engaging means thereon for engagement with a corresponding set of the receiving means on said housing to independently and removably support

said slide selector module with respect to said housing, a slide movably supported upon said bar for selective movement between plural switch positions on said bar corresponding to said sets of contact paths, and conductive means controlled by said slide for selectively contacting the conductive paths within a given set upon said circuit board when the slide is in any one of its plural positions to thereby complete a predetermined switching circuit associated with the contacted paths.

2. The slide selector switch term-assembly of claim 1 further including indicia means associated with said bar having switch position indicia thereon, and movable target means associated with the slide for selectively displaying an indicia associated with the selected switch position.

3. The slide selector switch term-assembly of claim 2 wherein detenting means are provided on said slide and corresponding serrations are provided on said bar adapted to cooperate with said detenting means to positively define the switch positions occupied by said slide.

4. The slide selector switch term-assembly of claim 3 wherein the contact means comprises a spring formed of conductive material having a bifurcated outer extension forming two contact bearing fingers that are adapted to contact and bridge the gap between two adjacent conductive paths on said circuit board.

5. The slide selector switch term-assembly of claim 4 wherein said indicia means is removably secured upon said bar.

6. The slide selector switch term-assembly of claim 1 further including a second slide movably supported upon said bar for movement between plural switch positions, and separation means on said bar for limiting the movement of the respective slides to different groups of switch positions.

7. The slide selector switch term-assembly of claim 1 having a plurality of sets of receiving means upon said housing and having a corresponding plurality of slide assembly modules.

8. A slide selector switch term-assembly comprising a housing formed of opposed sides secured to a top and a bottom, respectively, and having an open front and rear, with the sides of the housing having opposed sets of slots formed on the inner surfaces thereof;

a circuit board attached to the rear of said housing, having a plurality of sets of conductive paths thereon, with each set of conductive paths corresponding to a set of slots in said housing sides; and a plurality of independently removable slide selector modules, each of said slide selector modules including a non-signal carrying bar having end extensions adapted to fit within a pair of opposed slots in said housing sides for independently and removably engaging the module with the housing, said module further comprising a slide movably supported upon the bar for movement therealong, the slide having an indexing spring secured thereto and the bar having serrations formed along an edge facing the indexing spring, adapted to selectively receive the indexing spring to define plural switch positions for the slide, and an electrical contact secured to said slide, said electrical contact including a pair of contacts adapted to selectively contact and bridge the gap between adjacent current paths provided upon the circuit board when said slide is moved into one of the switch positions.

9. A slide selector switch term-assembly as described in claim 8 further including an indicia means removably secured upon said bar having switch position indicia formed thereon corresponding to each slide position and a movable target associated with said slide for selectively displaying an indicia associated with the selected switch position.

10. The slide selector switch term-assembly of claim 9 wherein the indicia means comprises a transparent strip having numerals printed on the rear face thereof in an opaque color, and wherein said target comprises a section of bright fluorescent material.

11. The slide selector switch term-assembly of claim 9 further including retaining strips secured to the rear edge of the housing and other retaining strips removably secured to the front edge of said housing to retain slide selector modules therein.

12. The slide selector switch term-assembly of claim 9 wherein the indicia means comprise an opaque strip having clear numbers formed therein, and wherein said target comprises a section of bright fluorescent material.

\* \* \* \* \*

50

55

60

65