March 24, 1970 J. BONACQUISTI 3,502,824

SLIDE SELECTOR CONTACT SWITCH WITH ORTHOGONAL U-SHAPED SPRING DETENT

Filed May 24, 1967 2 Sheets-Sheet 1

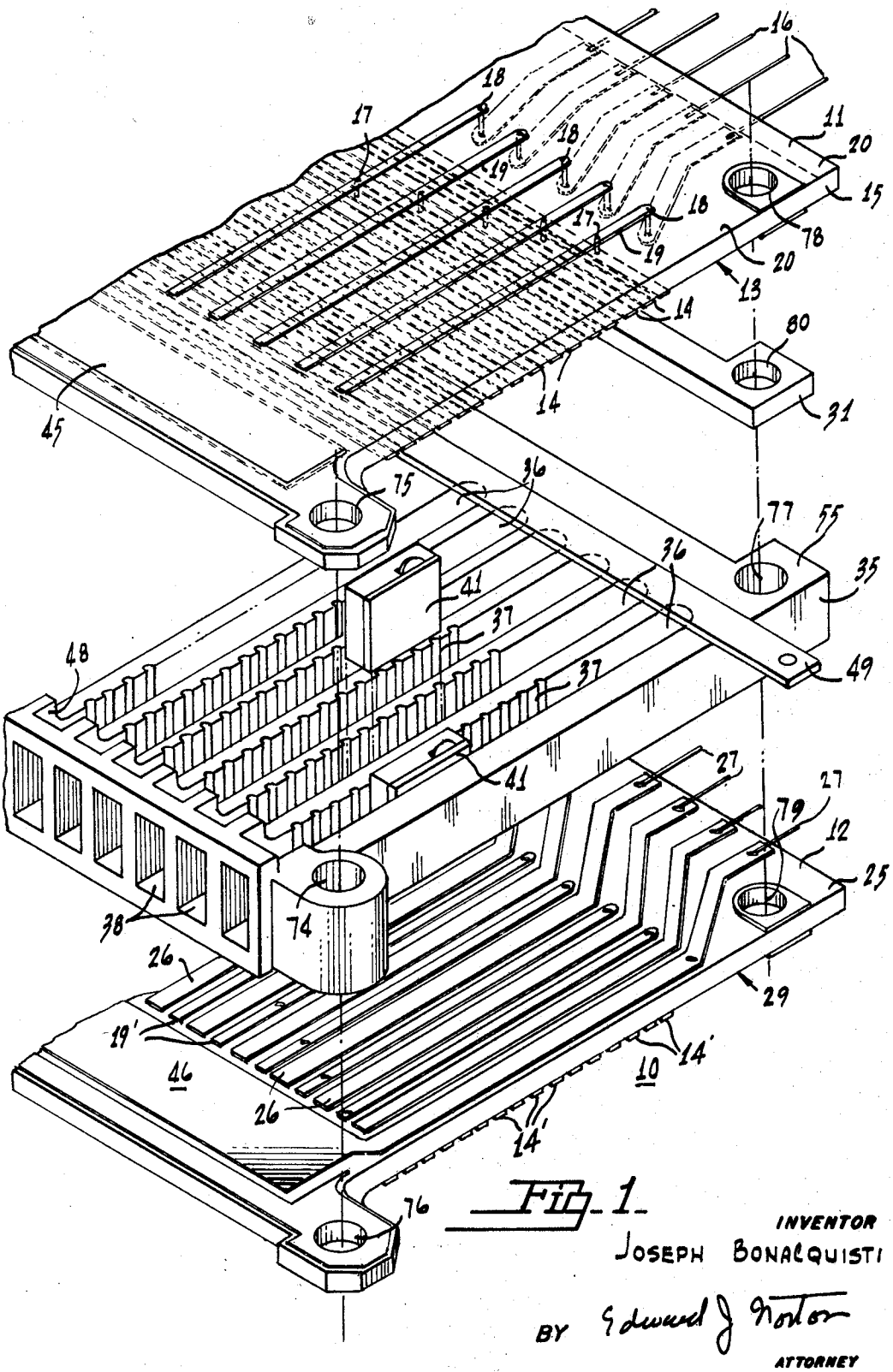


Fig. 1

INVENTOR
JOSEPH BONACQUISTI

BY Edward J Norton
ATTORNEY

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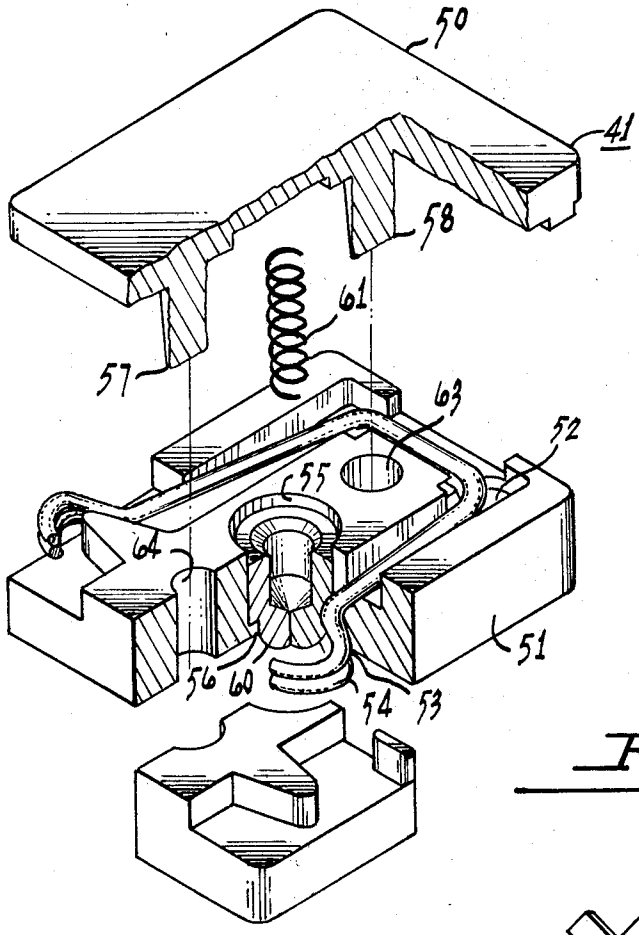


Fig. 2.

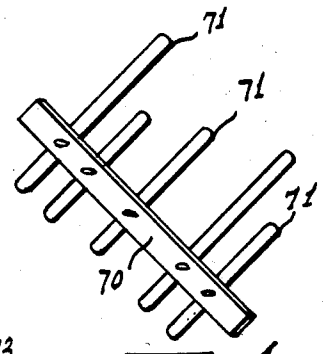


Fig. 4.

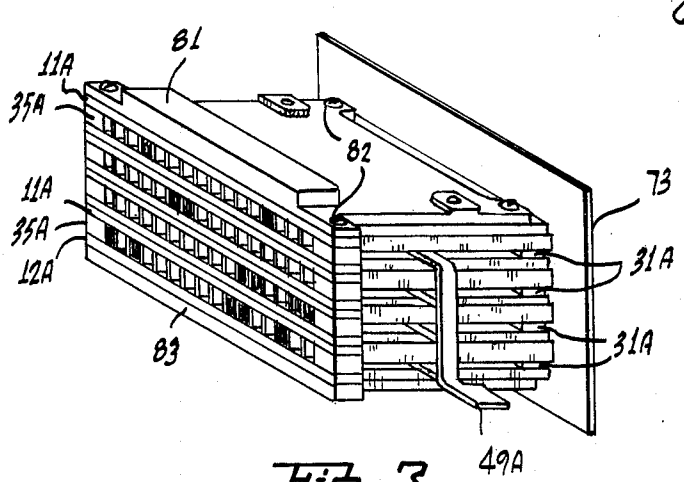


Fig. 3.

INVENTOR
JOSEPH BONACQUISTI

BY Edward J. Norton
ATTORNEY

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SLIDE SELECTOR CONTACT SWITCH WITH ORTHOGONAL U-SHAPED SPRING DETENT

Joseph Bonacquisti, Collingswood, N.J., assignor to RCA Corporation, a corporation of Delaware

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U.S. Cl. 200—16 7 Claims

ABSTRACT OF THE DISCLOSURE

A completely captive switch is disclosed which has a positive, precise detent mechanism that can be positioned at various determined settings in a cross bar selector switch and which gives a continuous electrical impulse reading while undergoing severe shock and vibration conditions.

The invention herein described was made in the course of or under a contract or subcontract thereunder with the Department of the Army.

This invention relates to a contact switch and more particularly to a new cross bar slide selector contact switch useful for programming and the like.

The invention resides in an improved cross bar selector switch which may readily be employed for example in data processing machines, communications, timing devices and electrical testing equipment of all sizes. Various types of cross bar switches are known and used in the state of the art. Many of these switches are constructed of loose parts which become difficult to assemble and once assembled become dislodged in handling or by shock and vibration.

It is an object of this invention to provide an improved cross bar selector switch which is relatively free from shock and vibration.

It is another object of this invention is provide an improved contact switch useful in a cross bar slide selector switch and the method of making the same.

A further object of this invention is to provide a completely captive switch with a positive precise detent mechanism which can be positioned at various determined settings and gives a continuous electrical impulse reading while undergoing thermal and shock conditions.

Briefly, a completely captive contact switch having a resilient conductive member protruding from opposed ends is spaced by a spacing member between a plurality of spaced parallel conductors and at least one other conductor transverse to the plurality of conductors. The spacing member has at least one slot therein for sliding the captive contact switch therealong between the plurality of conductors and at least the one other transverse conductor. The contact switch has a captive detent protruding from the contact switch body which is adapted to catch a plurality of grooves spaced at increments along the slot. The detent, the grooves, the conductive member and conductors are arranged so that, when the detent catches a selected groove, the detent positions and holds the protruding conductive member between a selected one of the plurality of conductors corresponding to the selected groove and the transverse conductor.

In order that the invention may be more clearly understood reference will now be made to the accompanying drawings which show one embodiment thereof by way of example only and in which:

FIGURE 1 shows a perspective view of part of one of the selector switch modules,

FIGURE 2 is an exploded view of a contact switch in accordance with this invention.

FIGURE 3 is a perspective view of a plurality of selector switch modules.

FIGURE 4 is a sketch of a programming gun which may be used in accordance with this invention.

Referring to FIG. 1, there is shown part of a selector switch module **10**. A number of the modules as shown in FIG. 1 may be coupled together to form a gang type assembly as shown in FIG. 3. The module **10** includes a baseboard **11** and a baseboard **12** made of a nonconductive material. Printed on the bottom surface **13** of baseboard **11** as shown in FIG. 1 are a plurality of spaced parallel conductors **14** (dotted lines) running in a first direction along the length of the baseboard **11**. These parallel conductors **14** extend from one edge to the opposite edge of baseboard **11** on the bottom surface **13**. Each of these spaced parallel conductors **14** terminate to a respective one of the terminals **16** through respective conductive feed through points **17** and **18** and respective printed conductor strips **19** on the opposite surface **20** of baseboard **11**. By placing the printed strips **19** on the opposed face **20**, the baseboard **11** insulates the strips **19** from the conductive strips **14** by the thickness **15** of the baseboard **11**.

The second baseboard **12** similar to and spaced parallel to baseboard **11** has printed on the top surface **25** a plurality of spaced parallel conductors **26**. The conductors **26** run across the width of the baseboard **12** in a direction perpendicular to the direction of the parallel conductors **14** on baseboard **11**. The conductors **26** run generally in the same direction as strips **19**. Termination of conductors **26** is provided at respective terminals **27** at the end of baseboard **12**. Baseboards **11** and **12** are spaced parallel to each other by a nonconductive spacer **35**. The spacer **35** has a plurality of equally spaced slots **36** therein that extend almost the full width of the module **10**. The equally spaced slots **36** are spaced so as to correspond with the plurality of conductors **26** on the top surface **25** of baseboard **12** so that a conductor **26** extends below and along each spaced slot **36**. A plurality of detent slots or grooves **37** adapted for housing a ball face button detent are spaced along one side of each of the slots **36**. The grooves **37** are spaced a given distance relative to the plurality of conductors **14** on the bottom surface **13** of baseboard **11**.

A slidable contact switch **41** more completely shown in the exploded view in FIG. 2 is provided having a first plastic cover half **50** and a second cover half **51**. The cov- of material may be a thermal plastic material. The dimensions of the cover **50–51** are determined so that the thickness of the cover **50–51** fits in a manner to slide snugly along a slot **36** and along a conductor **26** and so that the cover **50–51** and consequently switch **41** extends above the slotted portion of spacer **35** and slides snugly between baseboards **11** and **12**. In each contact switch there are two noble metal U-shaped resilient wire contacts **53–54**. Two silient wire contacts **53, 54** are used in the described embodiment to add redundancy and provide improved performance during shock and viibration. The two metal contacts **53–54** are lodged in a U-shaped cavity **52** formed in the first and second cover halves **50–51** of the contact switch **41**. The end portions of the U-shaped contacts **53–54** are bent to present a slidable contact surface. The end portions of contacts **53-54** protrude from the opposed side surfaces of plastic cover **50–51** so that, when the contact switches **41** are inserted into the slots **36** of spacer **35**, one end of contacts **53–54** makes contact with conductor **26** on baseboard **12** and the opposite end of contacts **53–54** makes contact with conductors **14** on baseboard **11**. A small ball faced button detent **60** and a spring **61** which spring loads the ball faced button detent **60** is encapsulated in the plastic cover **50–51**. A cylindrical shaped cavity **55** is located within the plastic cover **50–51** and extends from the center of the cover **50–51** to form

an opening through the second cover half **51** as shown in FIG. **2**. The diameter of the cavity **55** is made somewhat smaller at a portion **56** shown in FIG. 2 located near the opening for the detent **60** in the cover half **51**. The ball faced detent **60** is generally cylindrical shaped and is placed within the cavity **55** as shown in FIG. 2. The dimension of the detent **60** is made so that it slides snugly along the cavity **55**. The ball faced portion of the detent **60** is somewhat smaller in diameter than that of the remaining portion so that only the ball faced portion can protrude through the narrow opening and the remaining portion of the ball faced detent **60** is encapsulated within plastic cover **50–51**. The ball faced detent **60** is of the size and nature to engage and hold in the plurality of grooves **37** and yet be slidable along the slot **36**. The lengthwise axis of the button detent **60** and the length of the cavity **55** is such as to allow the ball faced portion of the button detent **60** to be depressed against the spring **61** flush to the plastic cover **50–51** to allow the contact switch **41** to be slid along the slot **36** in grooved increments to select the desired cross bar conductor **14** on baseboard **11**. The spring-loaded detent mechanism **60** and the wire contacts **53–54** are encapsulated within the plastic cover **50–51** by bonding the two plastic pins **57–58** in the associated apertures **63, 64**. The bonding may be done by ultrasonic welding. The position of the ball faced button detent **60** relative to the conductive contacts **53-54** is the same as the relative position of the groove **37** is to the selected cross switch conductor **14** so that when the contact switch **41** is in a given grooved position one end of the wire contacts **53–54** makes contact with an associated conductor **14** on baseboard **11** and the opposed end of wire contacts **53–54** makes contact with a conductor **26** on baseboard **12**.

In the operation of the above described cross bar selector switch, a plurality of contact switches **41** are slid along the slots **36** in precise increments by applying a probe member through openings **38** at one end of the respective slots **36**. The precise increments are the points at which ball faced detent **60** protrudes from the cover **50–51** to catch and lodge in one of the grooves **37**. At each precise increment that detent **60** lodges in a groove **37**, one end of the wire contact **53–54** couples the then selected corresponding conductor **14** to a given conductor **26** on baseboard **12**. The only exception to this case is when contact switches **41** are returned to the front position near openings **38** where one end of wire contacts **53–54** make contact with the wide zero level conductor **45** on the bottom surface **13** of baseboard **11** and where the opposite end of wire contacts **53–54** make contact with the wide zero level conductor **46** on the top surface of baseboard **12**. The zero position conductors are presented in FIGURE 1 as wider conductors which extend across the length of the board to present a zero position for all of the contact switches **41**. The contact switches are returned to the zero position on boards **11** and **12** respectively by means of a rake **49** which drags the plurality of contact switches **41** back to the zero level positions **45–46**. To allow for the rake assembly **49** to be operative, the spacer **35** is made so that the portion of the spacer wherein the slots **36** are located is thinner than the front portion **48**. A spacer **31** is added to space the back end of the module **10** the same amount as the front portion **48**. As mentioned previously the contact switch **41** has a width so that when the thickness of contact switch **41** is inserted into the slot **36** as shown in FIG. 1, it extends above the slot **36** a sufficient amount to allow the rake **49** to drag the switch back to the zero levels between conductors **45–46**. The contact switch extends above the slot the same height that the front portion **48** of the spacer **35** and the spacer **31** extends so as to place the contact switch **41** snugly between baseboards **11** and **12**.

Several of the modules as shown in FIGURE 1 may be ganged together to form a ganged type assembly as shown in FIG. 3. For example, the bottom surface portion **29** of baseboard **12** shown in FIG. 1 may carry a plurality of space conductors **14'** running across the length of the baseboard **12** similar to conductors **14** on baseboard **11** in FIG. 1 to form the top conductors of another module below module **10**. The top surface **20** of baseboard **11** may likewise be used to carry conductors similar to conductors **26** on baseboard **12** of another module above module **10**. The conductors printed on surface **20** of baseboard **11** may be running in the same direction as conductors **26** on baseboard **12**. The termination strips **19'** on baseboard **12** similar to that used for conductors **14** on baseboard **11** may be spaced between conductors **26** to act as termination strips for each of the conductors **14'** on baseboard **12**. The module **10** can be assembled together, for example, by passing a bolt through the four corners of the baseboards **11** and **12** and spacers **31** and **35**. Baseboards **11** and **12** are shown in FIG. 1 to have apertures **75, 76, 78** and **79** for the passage of a bolt therethrough. FIG. 1 also shows apertures **74, 77** and **80** for the passage of bolts through spacers **31** and **35**. The bolts may be made fast to nuts or a threaded end plate. Several modules similar to module **10** may likewise be assembled together as shown in FIG. 3 by passing bolts **82** through an end plate **81** and corresponding apertures located at the four corners of baseboards **11A** and **12A** and spacers **31A** and **35A**. The bolts **82** may be made fast to an end plate **83** located at the opposite end and threaded at the corresponding four corners. The output terminals **16** and **17** of the baseboards **11A** and **12A** may be coupled to a common printed circuit board **73** at one end of the baseboards **11A** and **12A**.

A programming gun **70** made up of a plurality of probes **71** of varying length indicative of a given program for the switch is shown in FIG. 4. When the probes **71** are inserted into the module **10** at end **38** shown in FIG. 1, the probes **71** slide the several contact switches **41** at once a given distance determined by the probe length to select a given program. A programming gun similar to that shown in FIG. 4 but of several tiers may be used to program the assembly shown in FIG. 3. Likewise several rakes can be tiered together to form a rake **49A** as shown in FIG. 3 which drags the contact switches **41** in the several modules of the assembly to the front zero level. Spacers **31A** in combination with the raised portion of spacer **35A** allows the rake **49A** to slide freely within the assembly.

What is claimed is:

1. A slide selector switch comprising:

a plurality of spaced non-movable parallel conductors,

at least one other non-movable conductor extending transverse to and spaced from said plurality of conductors,

means spacing said plurality of parallel conductors from said transverse conductor,

said spacing means defining at least one slot therein extending transversely of said plurality of parallel conductors and corresponding to said transverse conductor,

said spacing means defining said slot having grooves spaced along the length of said slot corresponding to each of said plurality of conductors,

at least one contact switch having a resilient conductor member protruding from opposed ends of the body of said switch and having a detent member extending from the body in a direction orthogonal to said conductor member and adapted to catch said spaced grooves,

said contact switch being slidably mounted within said slot with said detent member, said grooves, said protruding conductive member, and said conductors being arranged relative to one another to permit said contact switch to slide along said slot and said detent to catch a selected groove and thereby hold said protruding conductive member at one end in con-

tact with one of said plurality of conductors and at the opposite end in contact with said transverse conductor.

2. The combination as claimed in claim 1 wherein said detent member is a ball faced spring loaded detent member and said grooves are adapted to receive said ball faced detent member.

3. The combination as claimed in claim 1 wherein said contact switch has a contact switch cover and said conductive member is held within said cover and protrudes from opposed ends of said cover and said detent member is held within said cover with a portion protruding from said cover.

4. A slide selector switch comprising:

a plurality of spaced non-movable parallel conductors,

at least one other non-movable conductor extending transverse to and spaced from said plurality of parallel conductors,

means spacing said plurality of parallel conductors from said transverse conductor,

said spacing means defining at least one slot therein extending transversely of said plurality of parallel conductors and corresponding to said transverse conductors,

said spacing means defining said slot having a plurality of grooves spaced within and along the length of said slot a given relative distance from an associated one of each of said plurality of spaced parallel conductors,

at least one contact switch having a contact switch body adapted to and being slidably mounted along said slot,

said contact switch having a resilient conductive member protruding from opposed ends of said contact switch body and having a spring loaded detent member protruding from said body and adapted to catch and hold in said spaced grooves,

said detent and said protruding conductive member being spaced from one another said given relative distance so that when said detent catches a selected one of said grooves one end of said conductive member makes contact with said associated one of said plurality of conductors and the opposite end of said conductive member makes contact with said transverse conductor.

5. A slide selector switch comprising:

a first baseboard of insulating material having thereon a first plurality of spaced non-movable parallel individual circuit conductors,

a second baseboard of insulating material parallel to and spaced from said first baseboard having thereon a second plurality of spaced non-movable parallel individual circuit conductors extending transversely of said first plurality of spaced parallel conductors,

spacing means between said baseboards defining a plurality of slots formed therein extending transversely of said first plurality of conductors and corresponding to said second plurality of conductors, said spacing means defining each of said slots having grooves within and spaced along the length of said slots with each groove a given relative distance from an associated one of each of said first plurality of spaced conductors,

a plurality of slidable contact switches each having a cover and a conductive member held within said cover so that said conductive member protrudes from said cover at opposed ends thereof,

each of said contact switches having a ball faced spring loaded detent held within said cover with only the ball faced portion of said detent protruding from said cover,

said contact switches being individually slidably mounted relative to said first and second plurality of spaced

conductors within said plurality of slots and between said first and second baseboards so that as each of said contact switches slides along said slot said detent catches said grooves in precise increments to hold said contact switch at a selected position to make contact between one of said transverse conductors and one end of said conductive member and between the then selected one of said first plurality of conductors and the opposite end of said conductive member,

whereby a switch actuating means can be used to simultaneously slide said contact switches along said respective slots to complete selected electrical contact between said transverse conductors and said first plurality of conductors,

6. A contact switch for slidable use between spaced transverse conductors where the spacing member defines a slot with grooves spaced along the length of said slot at a given associated position relative to said conductors comprising:

an insulator body having a U-shaped cavity therein,

a U-shaped resilient conductive member located within said cavity with the end portions of said U-shaped member protruding from said body at opposed ends of said body,

a ball faced slidable detent member having the ball faced end smaller in diameter than the remainder of the detent, said body having a second cavity therein adapted to slidably mount said detent and allowing one said ball faced portion to protrude from one end of said body and thereby hold said detent therein,

a spring mounted within said second cavity of said body to spring load and hold said detent,

said detent member and said conductive member being arranged relative to each other so that when said switch is in said slot and said detent member catches a selected one of said grooves resulting in one protruding end of said conductive member contacting one of said transverse conductors the opposite protruding end of said conductive member contacts another conductor transverse to said one transverse conductor.

7. The combination called for in claim 6 wherein said insulator body has a first and second portion wherein said first portion has a U-shaped groove therein and a plastic pin extending from said groove side and said second portion has a U-shaped groove therein and an aperture and said first and second portions being positioned so that said grooved side of said first portion coincides with said grooves side of said second portion and said pin is positioned in said aperture.

References Cited

UNITED STATES PATENTS

Re. 24,586	1/1959	Davis	200—16
2,487,199	11/1949	Titcomb	200—16
3,022,814	2/1962	Bodine	156—73
3,146,141	8/1964	Woodland	156—73
2,916,674	12/1959	Dix	317—112
3,146,320	8/1964	Wang et al.	200—16 X

FOREIGN PATENTS

1,196,274	7/1965	Germany.

ROBERT K. SCHAEFER, Primary Examiner

R. A. VANDERHYE, Assistant Examiner

U.S. Cl. X.R.

200—5, 166; 317—112