United States Patent

Zdanys, Jr. et al.

[15] **3,643,046**

[45] **Feb. 15, 1972**

[54] MULTIPLE CONTACT SNAP ACTION SLIDE SWITCH

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[21] Appl. No.: **885,873**

[52] **U.S. Cl.** **200/76**, 200/68, 200/16

[51] **Int. Cl.** **H01h 15/18**

[58] **Field of Search** 200/68, 76, 77, 16, 78, 70, 200/67.7

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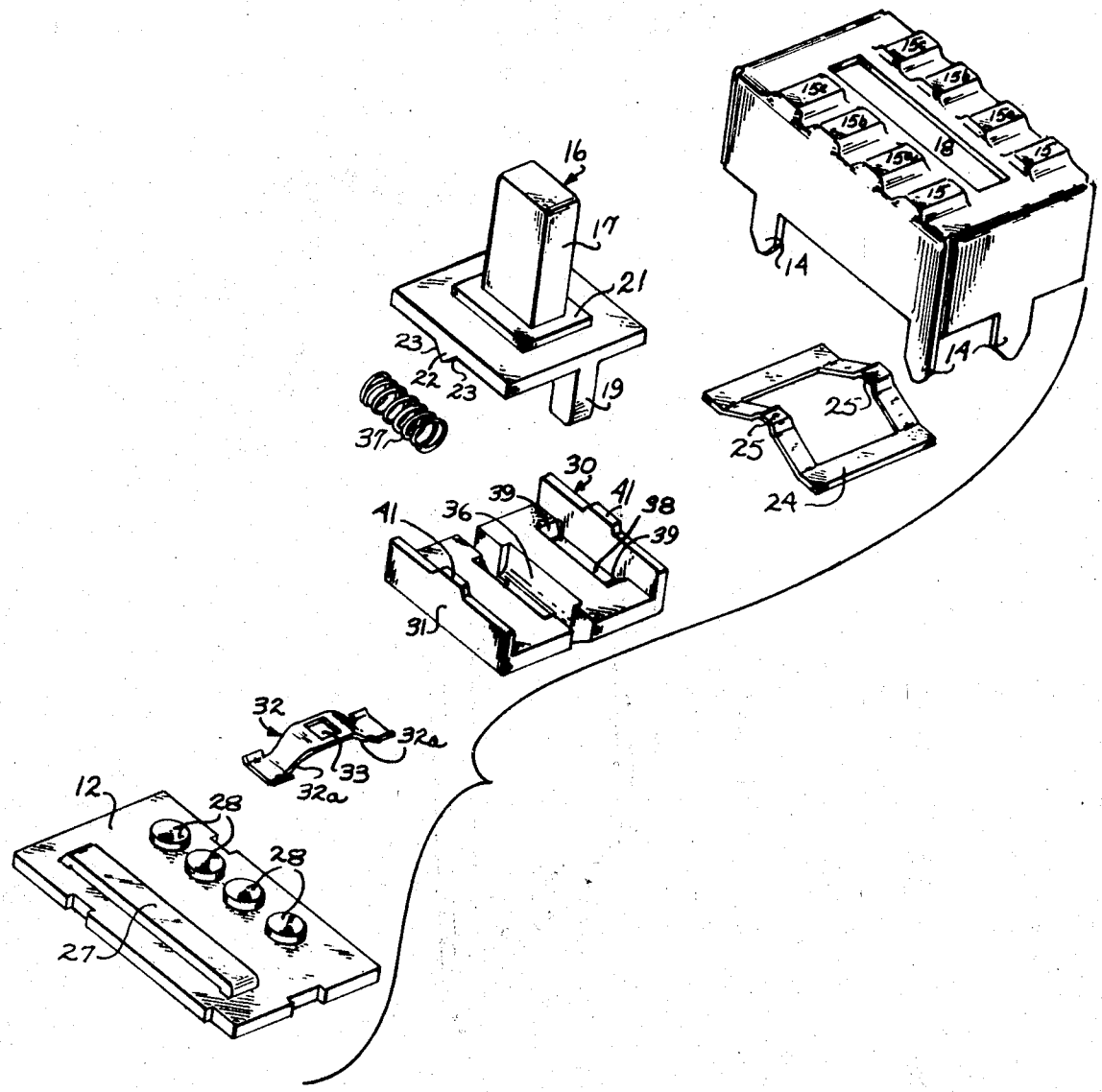
[57] **ABSTRACT**

A snap action slide switch is provided having a contactor assembly engaging a common contact and selectively engaging one of a plurality of discrete contacts. A slider extends outwardly through a slot in a housing containing the contacts and has legs extending over the ends of a spring seated in the contactor assembly thereby biasing the contactor assembly to move with the slider. Projections on the contactor assembly engage notches on the housing to position the contactor assembly in engagement with a selected discrete contact and the common contact and to restrain the contactor assembly from movement with the slider. Movement of the slider relative to the contactor assembly compresses the spring and moves a cam depending from the slider into engagement with a cam surface on the contactor assembly. Relative movement between the cam and cam surface produces pivoting of the contactor assembly and removal of the projections from the notches permitting the force of the compressed spring to snap the contactor assembly into engagement with another of the discrete contacts.

20 Claims, 6 Drawing Figures



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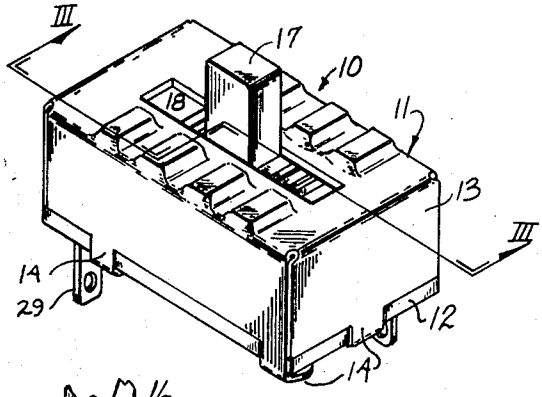


FIG. 1

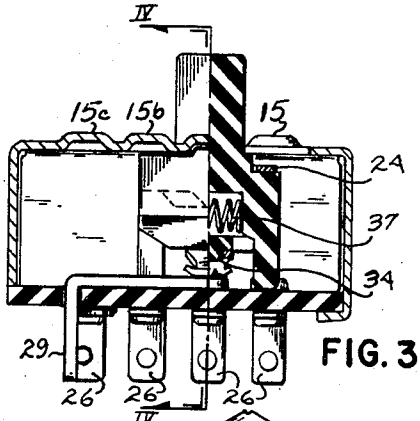


FIG. 3

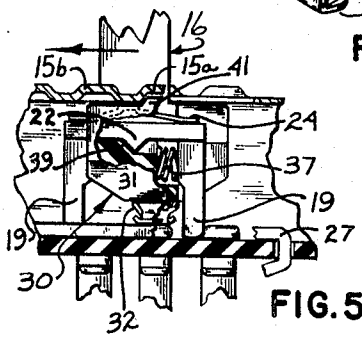
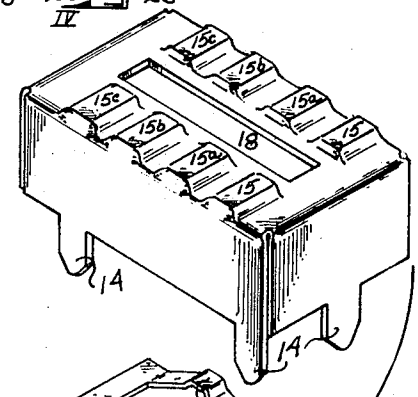


FIG. 5



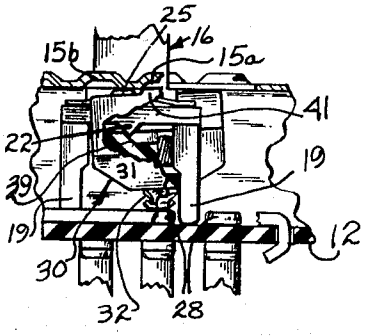
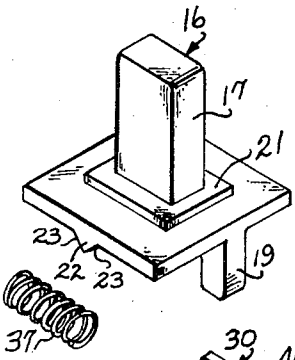
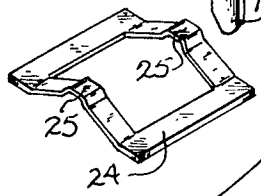
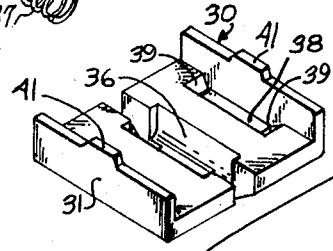
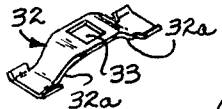


FIG. 6









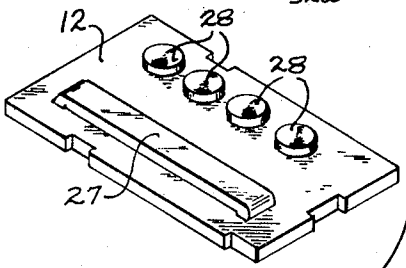


FIG. 2

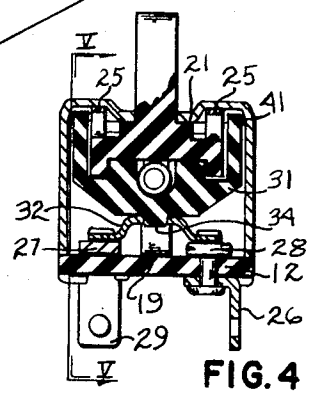


FIG. 4

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MULTIPLE CONTACT SNAP ACTION SLIDE SWITCH

This invention relates generally to electrical switches and, more particularly, to a multiple contact snap action electrical switch.

In the past there has been a large number of multiple contact switches such as that shown by Hoy et al., U.S. Pat. No. 3,223,794. These switches in general have been slow make, slow break. Because the movement of the contactor relative to the contacts has not been sufficiently rapid, destruction of either the bridging contactor or stationary contacts occurs due to arcing between the movable contactor and stationary contact surfaces when the contactor and contact surfaces are not in engagement. While the major cause of arcing is due to slow relative movement between the contactor and contact surfaces, arcing also occurs due to the movable contactor bouncing against the stationary contact surfaces as the switch is closed and due to insufficient contact pressure between the bridging contactor and stationary contact surfaces. Insufficient contact pressure also contributes to objectionably high contact resistance, i.e., the electrical resistance between the bridging contactor and stationary contact surfaces. It would be desirable to provide a multiple contact snap action slide switch capable of very rapidly making and breaking an electrical circuit designed so that one or more movable contactors within the switch cannot be held in a neutral or center position by teasing the switch, that is carefully controlling or manipulating the switch actuating member. Such a structure would be desirable to provide an improved economically producible switch wherein contactor bounce, arcing, burning and contact resistance within the switch housing is substantially eliminated or reduced and yet wherein such switch may be readily and inexpensively fabricated.

Accordingly it is an object of the present invention to provide a new and improved electrical switch having the various desirable features set forth above. Another object of the present invention is to provide a new and improved electrical switch wherein spring means operates to provide fast and crisp movement of a bridging contactor relative to a plurality of stationary contact surfaces. Still another object of the present invention is to provide a snap action switch that is tease proof, i.e., the switch cannot be held in a neutral or center position by carefully controlling or manipulating the switch actuating member. A further object of the present invention is to provide an electrical switch capable of performing a large number of cycles without destruction of the bridging contactor or stationary contacts due to arcing between such contactor and stationary contact surfaces. A still further object of the present invention is to provide a new and improved electrical switch wherein a slider stores energy in a spring upon initial movement and upon further movement releases the energy permitting the spring to rapidly snap a contactor assembly into engagement with contact surfaces. Further objects and advantages of the present invention will become apparent as the following description proceeds and the features of novelty characterizing the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

Briefly, the present invention is concerned with a multiple contact snap action slide switch employing a bridging contactor that selectively engages a common contact and one of a plurality of discrete contacts. In a preferred embodiment a contactor assembly is movable within a housing containing a plurality of discrete contacts and a common contact mounted on a dielectric base. A slider having a handle extending outwardly through a slot in the housing is resiliently connected to the contactor assembly by means of a spring seated in the contactor assembly. Legs of the slider extend over both ends of the spring to bias the contactor assembly to move with said slider. A plurality of notches in the housing cooperate with a projection on the contactor assembly to restrain the contactor from moving with initial movement of the slider. Movement of the slider relative to the contactor assembly compresses the spring and moves a cam depending from the slider into engagement with a cam surface on the contactor assembly. As the cam moves on the cam surface, the contactor assembly pivots on the bridging contactor until the projection is removed from the notch, at which time the compressed spring snaps the contactor assembly into engagement with another of the discrete contacts.

For a better understanding of the present invention reference may be had to the accompanying drawings wherein the same reference numerals have been applied to like parts and wherein:

FIG. 1 is an isometric view of an electrical switch control embodying the present invention;

FIG. 2 is an exploded view of the control shown in FIG. 1;

FIG. 3 is a sectional view taken along line III—III of FIG. 1;

FIG. 4 is a sectional view taken along line IV—IV of FIG. 3, assuming FIG. 3 to be shown in full; and

FIGS. 5 and 6 are fragmentary sectional views taken along line V—V of FIG. 4, assuming FIG. 4 to be shown in full, with parts broken away to illustrate the relative positions of the switch parts during operation.

Referring now to the drawings an electrical switch is generally indicated at **10** having a housing **11** comprising a plurality of walls including a dielectric base **12** and a metal cover **13**. Tabs **14** extend from the walls of the cover **13** and are folded over the dielectric base **12** to secure the base **12** to the cover **13**. The cover **13** is provided with restraining means comprising a plurality of pairs of notches **15**, **15***a*, **15***b*, **15***c* whose function will be described later.

The switch **10** is provided with an operating member of slider **16** having control operating means in the form of a handle **17**. The cover **13** is provided with an opening in the form of an elongated slot **18** through which the handle **17** extends. The slider **16** is preferably made of a one piece suitable dielectric material, however, the handle **17** could be made separately and secured to the main body of the slider **16**. A pair of legs **19** depend from the slider **16** into engagement with the dielectric base **12**. A shoulder **21** extending around the handle **17** slidably engages the cover **13** adjacent the slot **18**. The legs **19** and shoulder **21** serve to prevent the slider **16** from rocking when the handle **17** is moved longitudinally in the slot **18**. A cam **22** depends downwardly from the slider **16** on each side of a plane passing through the legs **19**. Each cam **22** comprises downwardly converging cam surfaces **23**. An apertured detent spring **24** is disposed on the slider around the shoulder **21**. The spring having a pair of detents **25** which project into one of the pair of notches **14**, **15***a*, **15***b*, **15***c* of cover **13** restrains inadvertent movement of the slider **16** relative to the cover **13**. This eliminates sloppy movement of the slider **16** in the housing **11**.

A contact track or common contact **27** and a plurality of discrete contacts **28** are positioned on the dielectric base **12**. Each discrete contact **28** is electrically secured to a terminal **26** extending outwardly of the housing **11** for connection to an electrical circuit. As shown in FIG. **4** the discrete contact **28** extends through the dielectric base **12**, passes through a hole in the terminal **26** and is deformed over the terminal **26** to secure the discrete contact **28** to the terminal **26**. The common contact **27** formed with one end comprising an integral terminal **29** passing through an opening in the base **12**, extends outwardly of the housing **11** for connection to an electrical circuit. In FIG. **5** the other end of the common contact **27** is shown passing through an opening in the base **12** and folded over the base **12** to secure the common contact **27** to the base **12**. Since the common contact **27** simply provides means for establishing a closed circuit with the discrete contacts **28** and the terminals **26** and **29** many different constructions could be utilized depending upon the switch application. Where it is desired to operate more than one circuit it would be necessary to have more than one common contact **27** and one terminal **29**. Such a construction could be provided by splitting the common contact **27** and extending a terminal **29** from both portions or by replacing the common contact **27** with a plurality of individual contacts similar to discrete contacts **28**, each having a terminal extending outwardly of the housing **11**.

As best shown in FIG. 2, a contactor assembly 30, comprising a driver 31, preferably made of a suitable dielectric material, and a conductive bridging contactor 32, is positioned within the housing engaging the common contact 27 and selectively engaging one of the discrete contacts 28 to establish a closed circuit therebetween. The bridging contactor 32 is provided with an opening 33 adapted to receive an extension 34 (see FIG. 4) depending from the driver 31. By making the bridging contactor 32 of a suitable resilient material, the arms 32*a* of the contactor bias the opening 33 into engagement with the extension 34. Ordinarily the resilient force of the bridging contactor 32 is sufficient to maintain engagement of extension 34 in opening 33 and constrain the bridging contactor 32 to move with the driver 31, however, the contactor 32 may be additionally secured in any suitable manner, e.g., the end portion of extension 34 could be deformed over the portion of the contactor 32 surrounding opening 33. The driver 31 is provided with a groove 36 which seats a resilient means in the form of a spring 37. On each side of the groove 36 a channel 38 is provided with outwardly diverging tapered end surfaces 39 providing cam surfaces for cooperating with cams 22 on the slider 16. When the switch 10 is assembled the cams 22 are positioned to ride in the channels 38. Projections 41 extend upwardly from the driver 31 for engagement in one of the pair of notches 15, 15*a*, 15*b*, 15*c* of cover 13. The resilient force of the bridging contactor 32 biases the projections 41 into one of the pair of notches 15, 15*a*, 15*b*, 15*c*. Switch 10 is assembled with the legs 19 of the slider 16 positioned over the ends of the spring 37. The interaction of the spring 37 with the legs 19 resiliently biases the driver 31 to move with the slider 16. Since the driver 31 is restrained from movement due to engagement of projections 41 in one of the pair of notches 15, 15*a*, 15*b*, 15*c*, before movement of the driver 31 can occur the projections 41 must be disengaged from one of the pair of notches 15, 15*a*, 15*b*, 15*c*. As will be later described movement of cams 22 against cam surfaces 39 provides releasing means to disengage projections 41 from notches 15, 15*a*, 15 *b*, 15*c*. Since the contactor assembly 30 is restrained from moving with the slider 16 while projections 41 are positioned in one of the pair of notches 15, 15*a*, 15*b*, 15*c*, the spring 37 permits relative movement between the contactor assembly 30 and the slider 16. During such relative movement the spring 37 will be compressed by one of the legs 19.

The operation of the switch is best explained by reference to FIGS. 5 and 6. FIG. 5 shows the position of the various elements of the switch 10 after initial movement of the slider 16 in the direction of the arrow. Since the driver 31 is restrained from moving with the slider 16 due to engagement of projections 41 in notches 15*a*, such movement produces relative movement between the driver 31 and the slider 16. As is apparent the detent spring 24, constrained to move with the slider 16, has moved so as to disengage the detents 25 from notches 15*a*. One of the legs 19 of the slider 16 has compressed the spring 37 thereby biasing the contactor assembly 30 to move with the slider 16. As shown in FIG. 5 one of the cams 22 depending from the slider 16 abuts the cam surface 39 of the channel 38. As shown in FIG. 6 further movement of the slider 16 from its position in FIG. 5 relative to the contactor assembly 30 will force the cam 22 to move upwardly relative to the cam surface 39. Since the slider 16 is constrained from rocking due to engagement of the legs 19 against the base 12, and engagement of the shoulder 21 against the housing 11, the contactor assembly 30 pivots counterclockwise. Such further movement of the slider 16 from its position in FIG. 5 relative to the contactor assembly 30 overcomes the resilient pressure of the bridging contactor 32 causing the contactor assembly 30 to pivot counterclockwise about an axis passing through the points of engagement of the arms 32*a* of bridging contactor 32 with the contacts 27 and 28. This pivoting begins movement of the projections 41 out of engagement from the notches 15*a*. FIG. 6 shows the switch 10 just prior to movement of the contactor assembly 30 into engagement with an adjacent discrete contact 28. Additional movement of the slider 16 from its position in FIG. 6 will start movement of the detents 25 into engagement in the notches 15*b* adjacent to the notches 15*a*. Such additional movement of the slider 16 permits the contactor assembly 30 to pivot sufficiently to remove the projections 41 from notches 15*a* at which time the force built up in the compressed spring 37 will snap the contactor assembly 30 into engagement with the next adjacent discrete contact 28 and maintain contact with the common contact 27. It is readily apparent that the bridging contact 32 will remain in contact with discrete contact 28 until the projections 41 are removed from the notches 15*a* whereupon the bridging contactor 32 moves rapidly into engagement with the next adjacent discrete contact 28. This rapid motion substantially eliminates arcing and corresponding destruction of either the bridging contactor 32 or stationary contacts, discrete contacts 28 and common contact 27, occurring in the slow-make, slow-break switches shown in the prior art. As the bridging contactor 32 comes into engagement with the next adjacent discrete contact 28, the projection 41 engages the adjacent notch 15*b* in the housing 11 thereby preventing the contactor assembly 30 from bouncing back due to the resilient force of the bridging contactor 32 ordinarily tending to force the bridging contactor 32 away from the discrete contact 28. Each pair of notches 15, 15*a*, 15*b*, 15*c*, corresponds to one of the discrete contacts 28 so as to ensure positioning the bridging contactor 32 in engagement with one of the discrete contacts 28 when the projections 41 are engaged in the corresponding pair of notches 15, 15*a*, 15*b*, 15*c*

Since the detents 25 on the detent spring 24 are moving into the adjacent notches 15*b* as the projections 41 on the contactor assembly move out of the notches 15*a*, the switch 10 is tease proof since the slider 16 cannot be held so as to hold the bridging contactor 32 in a neutral or center position. Also in accord with the present invention, as the slider moves from one switch position to another switch position and pivots the contactor assembly to remove the projections 41 from the notches 15*a*, the contactor assembly is forced downwardly. Such downward movement of the contactor assembly increases the contact pressure of the arms 32*a* of the bridging contactor against the pair of discrete contacts and moves the contact areas between the arms 32*a* of the bridging contactor and the pair of discrete contacts outwardly before the bridging contactor starts to move and break the circuit. This shift or wiping of the contact areas before breaking assures long life of the switch because any small degree of arcing and burning of the contacts and arms 32*a* does not affect or cause an increase in contact resistance between the arms 32*a* and the contacts after many operations of the switch.

The operation of the switch 10 has been described for a movement of the slider 16 in a direction from right to left in FIGS. 5 and 6, however, it is to be understood that the same principles of operation apply when the slider 16 is moved from left to right in FIGS. 5 and 6. It is to be noted that while four discrete contacts 28 are shown the specific number of positions does not affect the motion from one position to an adjacent position. Thus it is seen that the invention provides a slide switch 10 with snap action motion of a contactor 32 between multiple positions in selective engagement with a common contact 27 and one of a plurality of discrete contacts 28.

While there has been illustrated and described what is at present consideration the preferred embodiment of the invention, it will be appreciated that numerous changes and modifications are likely to occur to those skilled in the art and it is intended in the appended claims to cover all of those changes and modifications which fall within the true spirit and scope of the present invention.

We claim:

1. A multiple contact slide switch comprising a housing having a plurality of walls, said housing having an opening extending through one of said walls, a plurality of discrete contacts mounted within said housing, a contactor assembly movable within said housing for selectively engaging two of said dis-

crete contacts to establish a closed circuit therebetween, a slider having a handle extending outwardly through said opening, resilient means biasing said contactor assembly to move with said slider, said resilient means permitting relative movement between the contactor assembly and the slider, restraining means releasably maintaining said contactor assembly positioned in engagement with said two of said discrete contacts, and releasing means whereby a predetermined movement of said slider relative to said contactor assembly actuates said releasing means and releases said contactor assembly from said restraining means thereby permitting said resilient means to move said contactor assembly to a position in engagement with another two of said discrete contacts at least one of which is different from said first two, said releasing means comprising a pair of first cam surfaces and a pair of second cam surfaces, one of said slider and said contactor assembly having a channel formed therein having diverging tapered end surfaces defining said second cam surfaces, said first cam surfaces being positioned in said channel, said predetermined movement of said slider relative to said contactor assembly causing one of said first cam surfaces to engage one of said second cam surfaces and move relative thereto.

2. The switch of claim 1 wherein said restraining means comprises a plurality of notches in said housing, a projection on said contactor assembly selectively engages one of said notches.

3. The switch of claim 2 wherein a detent spring is positioned on said slider to engage the notches in said housing and prevent inadvertent movement of said slider.

4. The switch of claim 2 wherein said contactor assembly comprises a driver having a groove, and a conductive contactor positioned on said driver, said resilient means being a spring seated in said groove, a pair of legs on said slider extend over the ends of said groove for compressing said spring upon relative movement between said driver and said slider when said projection is positioned in one of the notches.

5. The switch of claim 1 wherein said contactor assembly comprises a driver and a conductive contactor, said predetermined movement pivoting said driver on the conductive contactor.

6. A multiple contact slide switch comprising a housing, a plurality of discrete contacts mounted within said housing, a contactor assembly movable within said housing engaging said contact track and selectively engaging two of said discrete contacts to establish a closed circuit therebetween, a slider mounted for movement relative to said contactor assembly, control operating means for moving said slider relative to said contactor assembly, resilient means for biasing said contactor assembly to move with said slider, said resilient means permitting relative movement between the contactor assembly and the slider, restraining means for releasably maintaining said contactor assembly positioned in engagement with two of said discrete contacts, and releasing means for releasing said contactor assembly from said restraining means upon a predetermined movement of said slider relative to said contactor assembly, said releasing means comprising a cam having a pair of first cam surfaces on one of said slider and said contactor assembly and a pair of second cam surfaces on the other of said slider and said contactor assembly whereby said predetermined movement causes one of said first cam surfaces to engage one of said second cam surfaces and move relative thereto, said cam having downwardly converging tapered surfaces defining said first cam surfaces, and the other of said slider and said contactor assembly having a channel formed therein having upwardly diverging tapered end surfaces defining said second cam surfaces, said cam being positioned in said channel.

7. The switch of claim 6 wherein said restraining means comprises a plurality of notches in said housing, a projection on said contactor assembly selectively engages one of said notches.

8. The switch of claim 7 wherein said contactor assembly comprises a driver having a groove, and a conductive contactor positioned on said driver, said resilient means being a spring seated in said groove, a pair of legs on said slider extend over the ends of said groove for compressing said spring upon relative movement between said driver and said slider when said projection is positioned in one of the notches.

9. A multiple contact slide switch comprising a housing having a plurality of walls, said housing having a slot extending through one of said walls, a slider having a handle extending outwardly through said slot, a plurality of discrete contacts positioned within said housing, a contactor assembly movable within said housing for selectively engaging two of said discrete contacts to establish a closed circuit therebetween, a spring biasing said contactor assembly to move with said slider, said spring permitting relative movement between the contactor assembly and the slider, restraining means releasably maintaining said contactor assembly positioned in engagement with said two of said discrete contacts, a pair of first cam surfaces on said contactor assembly, a pair of second cam surfaces on said slider whereby a predetermined movement of said slider relative to said contactor assembly causes one of said first cam surfaces and one of said second cam surfaces to matingly engage and release said contactor assembly from said restraining means thereby permitting said spring to move said contactor assembly into engagement with another of said discrete contacts, said contactor assembly having a channel formed therein having upwardly diverging tapered end surfaces defining said first cam surfaces and said slider having a depending cam having downwardly converging tapered surfaces defining said second cam surfaces, said cam being positioned in said channel.

10. A snap action multiple contact slide switch comprising a housing having a plurality of walls, said housing having a slot extending through one of said walls, a plurality of discrete contacts mounted within said housing, a terminal electrically connected to each of said discrete contacts, said terminals extending outwardly from said housing for connection to an electrical circuit, a contactor assembly movable within said housing for selectively engaging two of said discrete contacts to establish a closed circuit therebetween, a plurality of notches in said housing, a projection on said contactor assembly engaging one of said notches to maintain said contactor assembly in engagement with the two discrete contacts, a slider having a handle extending outwardly of said housing through said slot, a spring biasing said contactor assembly to move with said slider, said spring permitting relative movement between said slider and said contactor assembly, engagement of said projection in said notch releasably restraining said contactor assembly against movement with said slider, a first cam surface on said contactor assembly, a second cam surface on said slider whereby a predetermined movement of said slider relative to said contactor assembly causes said cam surfaces to matingly engage and move relative to each other to release said projection from said notch thereby permitting said spring to move said contactor assembly into engagement with another of said discrete contacts and move said projection into engagement with another of said notches, said contactor assembly having a groove and said spring being seated in said groove, a pair of legs on said slider extending over the ends of said groove for compressing said spring upon relative movement between said driver and said slider when said projection is positioned in one of said notches, said legs extending to the wall opposite the wall having said slot to restrain said driver from rocking.

11. The switch of claim 10 wherein said contactor assembly comprises a driver and a conductive contactor, movement of said cam surfaces relative to one another pivoting said driver on the conductive contactor and releasing said projection from said notch.

12. In a multiple contact slide switch the combination comprising a housing, a plurality of discrete contacts mounted within said housing, a contactor assembly movable within said housing selectively engaging two of said discrete contacts to establish a closed circuit therebetween, a slider mounted for

movement relative to said contactor assembly, control operating means for moving said slider, resilient means for permitting relative movement between the contactor assembly and the slider, restraining means for releasably maintaining said contactor assembly positioned in engagement with one of said discrete contacts, and releasing means whereby a predetermined movement of said slider relative to said contactor assembly actuates said releasing means and releases said contactor assembly from said restraining means, said releasing means comprising a pair of first cam surfaces and a pair of second cam surfaces, one of said slider and said contactor assembly having a depending cam having converging tapered surfaces defining said pair of first cam surfaces, the other of said slider and said contactor assembly having a channel formed therein having end surfaces defining said second cam surfaces, said cam being positioned between said pair of second cam surfaces.

13. The switch of claim 1 wherein the other of said slider and said contactor assembly has a depending cam having converging tapered surfaces defining said pair of first cam surfaces.

14. The switch of claim 4 wherein said legs extend to the wall opposite said one of said walls to restrain said driver from rocking.

15. The switch of claim 14 wherein a detent spring is positioned on said slider to engage the notches in said housing and prevent inadvertent movement of said slider.

16. The switch of claim 8 wherein said legs extend to the wall opposite said one of said walls to restrain said driver from rocking.

17. The switch of claim 9 wherein a pair of legs on said slider extend over the ends of said spring for compressing said spring upon relative movement between said driver and said slider, said legs extending to the wall opposite said one of said walls to restrain said driver from rocking.

18. The switch of claim 21 wherein said contactor assembly comprises a driver having a groove, and a conductive contactor positioned on said driver, said resilient means being a spring seated in said groove, a pair of legs on said slider extend over the ends of said groove for compressing said spring upon relative movement between said driver and said slider when said projection is positioned in one of the notches.

19. The switch of claim 18 wherein said restraining means comprises a plurality of notches in said housing, a projection on said contactor assembly selectively engages one of said notches.

20. The switch of claim 18 wherein said legs extend to a wall of the housing to restrain said driver from rocking.

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