Dec. 27, 1960 W. GLUCK 2,966,560

SLIDE SWITCH

Filed Nov. 26, 1958 3 Sheets-Sheet 1

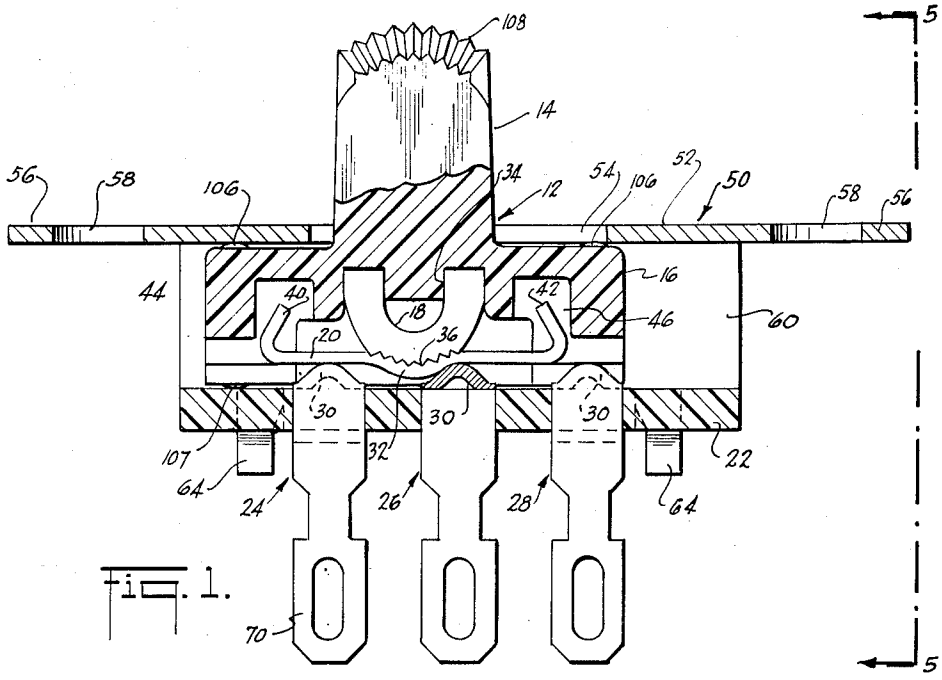


Fig. 1.

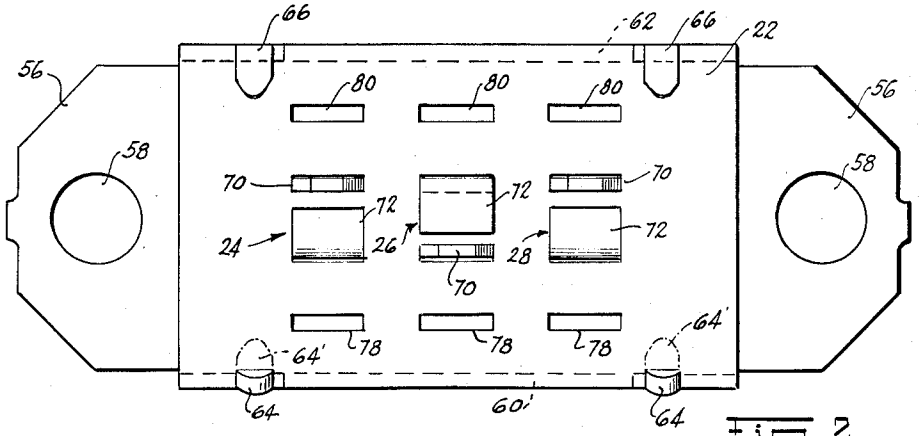


Fig. 2.

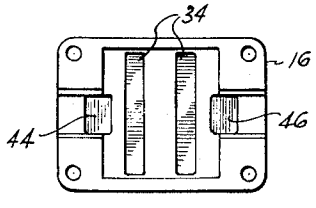


Fig. 3.

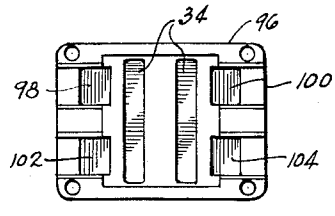


Fig. 4.

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Dec. 27, 1960 W. GLUCK 2,966,560

SLIDE SWITCH

Filed Nov. 26, 1958 3 Sheets-Sheet 2

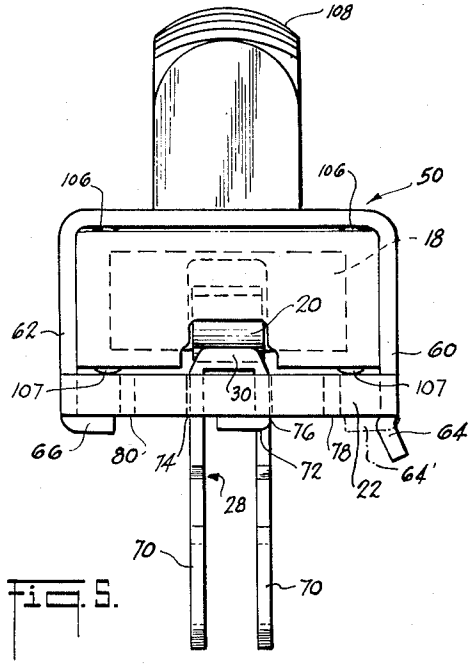


Fig. 5.

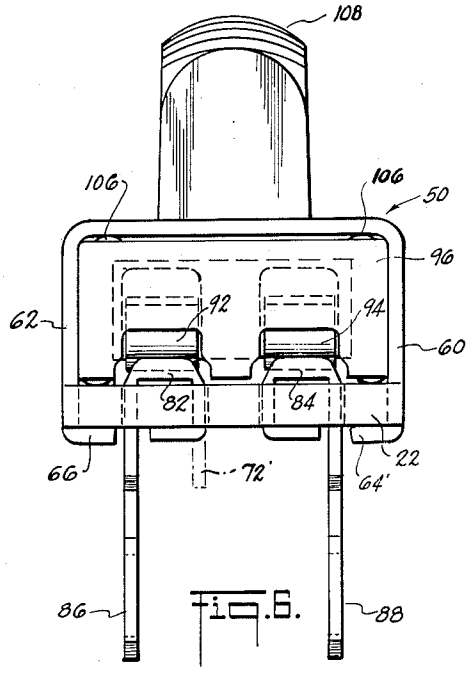


Fig. 6.

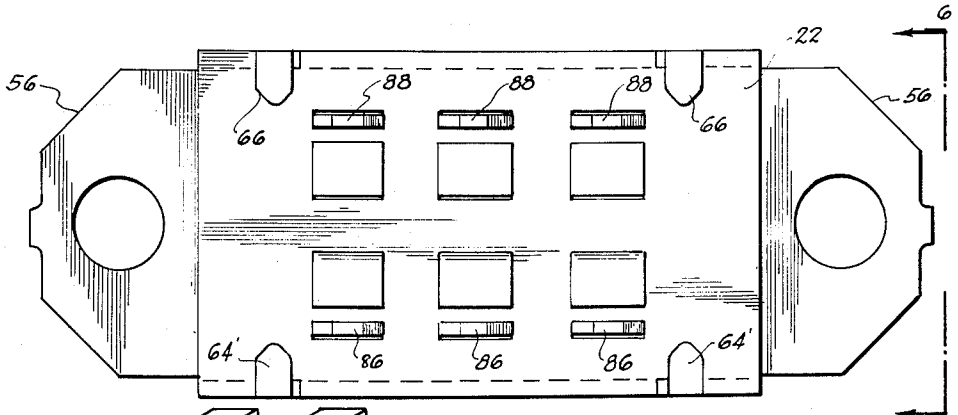


Fig. 7.

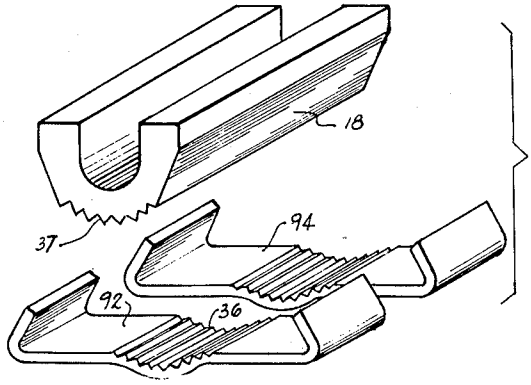


Fig. 8.

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Dec. 27, 1960 W. GLUCK 2,966,560

SLIDE SWITCH

Filed Nov. 26, 1958 3 Sheets-Sheet 3

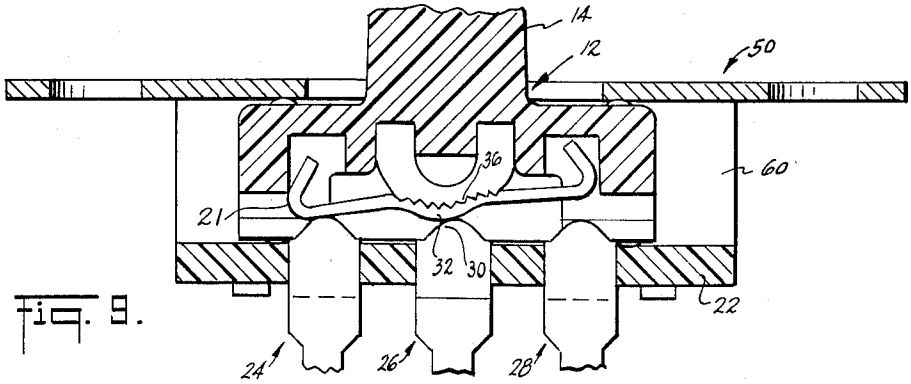


Fig. 9.

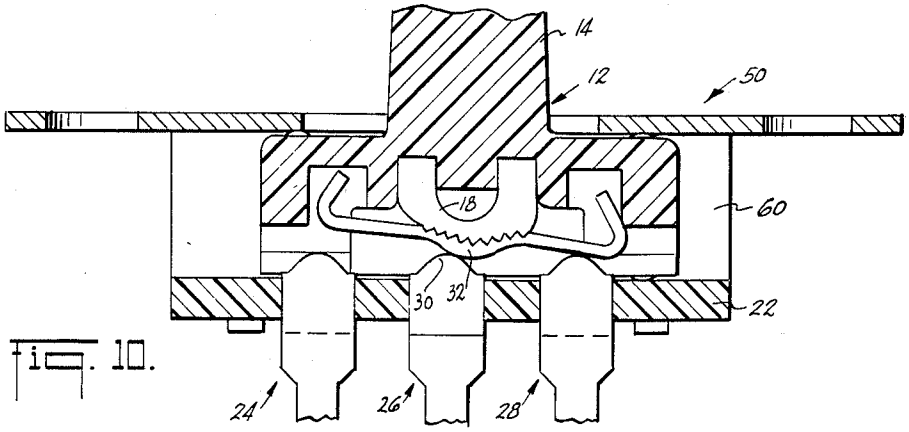


Fig. 10.

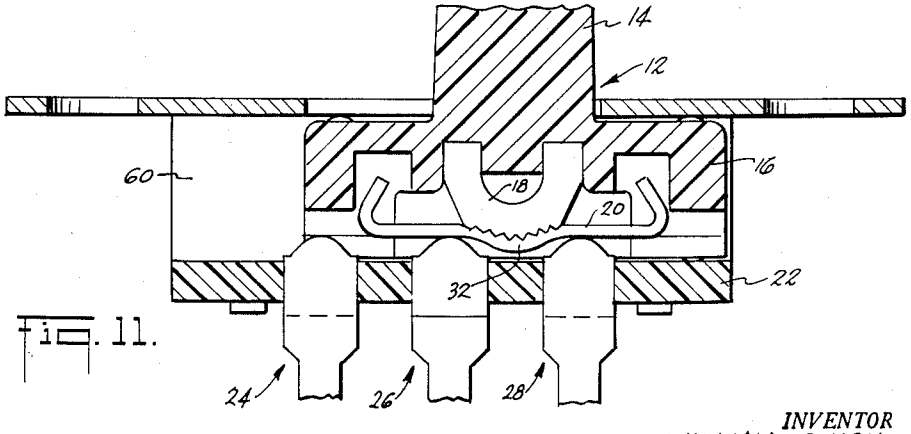


Fig. 11.

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2,966,560

SLIDE SWITCH

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Filed Nov. 26, 1958, Ser. No. 776,598
10 Claims. (Cl. 200—16)

This invention relates to switches for electrical circuits, and more particularly to slide switches.

The primary object of the present invention is to generally improve electrical switches. A more particular object is to improve electrical switches of the slide type.

Further objects are to provide such a switch which is compact, simple, inexpensive, dependable, and which has a snap action to minimize arcing.

Another object is to provide a switch which is readily made in single pole or double pole form with a minimum change of parts.

To accomplish the foregoing general objects, and other more specific objects which will hereinafter appear, my invention resides in the electrical switch elements and their relation one to another as are more particularly described in the following specification. The specification is accompanied by drawings in which:

Fig. 1 is a longitudinal section through a switch embodying features of the invention;

Fig. 2 is a bottom view of a single pole switch;

Figs. 3 and 4 are explanatory of one difference between the single pole and double pole forms of the switch;

Fig. 5 is an end view of a single pole switch;

Fig. 6 is an end view of a double pole switch;

Fig. 7 is a bottom view of the double pole switch shown in Fig. 6;

Fig. 8 is a perspective view explanatory of a detail; and

Figs. 9, 10 and 11 are longitudinal sections similar to Fig. 1 but showing successive positions of the parts to explain the operation of the switch.

Referring to the drawing, and more particularly to Figs. 1, 2 and 5, the switch comprises a horizontally slidable insulation handle generally designated **12**, said handle having an upwardly projecting finger piece or knob **14**, and a generally horizontal body **16**. A resilient means **18** is carried by and beneath the body **16**, and a generally horizontal metal slide **20** is carried by and beneath the resilient means **18** and the body **16**.

There is also an insulation base **22** with three spaced terminals generally designated **24**, **26** and **28** mounted in stationary position beneath the slide **20**. The terminals are each upwardly convex as is indicated at **30**, and the slide **20** has a downward bump or convexity indicated at **32**. The dimensioning and spacing of the parts is such that in one end position of the handle, say to the left as shown in Fig. 1, the slide **20** overlies and bears down on an end terminal **24** and the center terminal **26**, with the downward convexity **32** located therebetween, and in the opposite end position of the handle, that is, to the right as shown in Fig. 11, the slide **20** overlies and bears downwardly on the center terminal **26** and the other end terminal **28**, with the bump **32** located therebetween.

An important feature of the switch is the tilting action of the slide to provide an abrupt changeover which minimizes arcing. This may be explained with reference to and by comparison of Figs. 1, 9, 10 and 11 of the drawing. In Fig. 1 the handle is nearly in left position, and a circuit is established between terminals **24** and **26**, while terminal **28** is "open." The handle is shown slightly to the right of its leftmost position, but there would be no significant change in relation of parts if the handle were slightly further to the left. In Fig. 9 the handle **12** has been moved to mid position. The fulcrum bump **32** has been forced up the slope **30** of contact **26**. The

resilient means **18** is deformed or biased somewhat to the left because the slide **20** resists movement to the right. Longitudinal clearance at the ends of the slide **20** has been taken up at **21**. The center of downward force exerted on the slide by the resilient means **18** is somewhat left of center even when the handle **12** has reached center, and the slide **20** remains in the tilted position shown in Fig. 9, so that electrical contact is still maintained between the terminals **24** and **26**, while terminal **28** is still "open."

However, on slight further movement toward the right of handle **12**, the effective fulcrum point of the bump **32** passes the highest point of contact convexity **30**, whereupon the slide **20** is abruptly tilted in opposite direction, as shown in Fig. 10. The sudden or "snap-action" change from one tilted position to the opposite tilted position minimizes arcing. The desired snap action is aided by the resilient means **18**, which changes abruptly from a lagging bias or deformation, to a leading bias or deformation as shown in Fig. 10, because fulcrum **32** skids down the right side of convexity **30**. There are two cooperating fulcrums, rather than one. At this time, the terminals **26** and **28** are electrically connected, and the terminal **24** is "open."

The finger pressure on knob **14** causes the handle to move the rest of the way to the right, as shown in Fig. 11, with the slide **20** overlying and bearing downwardly on the contacts **26** and **28**, with the fulcrum **32** therebetween. At this time the resilient member **18** centers itself, that is, it returns to its normal symmetrical shape. In practice, the motion of the handle from one extreme position to the other is a single quick movement, with increased force needed to pass the midpoint, and the changeover caused by the fulcrum action becomes an instaneous snap-action which occurs without the attention or knowledge of the operator.

In the form of the switch here illustrated, the knob **14** and body **16** are an integral piece of molded plastics material, typically a phenolic resin such as "Bakelite." The resilient means **18** is a pad of elastic material. It is preferably a channel-shaped piece of synthetic rubber. What is desired is a material having the elastic characteristics of rubber, and which is not temperature sensitive, which does not corrode copper or brass, and which has good aging quality, in addition to high resilience and a low "compression set" value. Neoprene is a highly satisfactory material for the present purpose. Silicone rubber is also a good material for the purpose, but at present is more costly than neoprene.

The body **16** has a pocket or concavity to receive the pad **18**. When the pad is channel shaped as here shown, the body **16** has a pair of pockets **34** to receive the upper portions of the pad. These mating pockets are also shown at **34** in Figs. 3 and 4 of the drawing.

To help insure the desired deformation of the pad and the snap action previously described, the pad and slide are preferably interlocked at the fulcrum. More specifically, the top of the slide **20** is concave directly above the fulcrum part **32**, and the lower end of the pad is received in the resulting concavity. In addition the slide **20** is preferably serrated as shown at **36**, and the bottom of the pad is matingly serrated, as shown at **37** in Fig. 8.

The initial vertical dimension of the pad is preferably greater than that shown in Figs. 1 and 11 of the drawing. The pad is so dimensioned that it is compressed or preloaded when the parts of the switch are assembled.

Reverting to Fig. 1, the ends of the slide **20** are preferably turned upward as is indicated at **40** and **42**. These upturned ends are received in pockets **44** and **46** formed in the bottom of handle body **16**. The parts are so dimensioned that the upturned ends of the slide insure its horizontal movement with the handle, but the pockets are

large enough above the ends 40, 42 not to interfere with the desired tilting action of the slide shown in Figs. 9 and 10 of the drawing. The enlargement of the pockets 44, 46 also accommodates a rise of both ends, this being a condition which exists only momentarily in the middle of the snap-action changeover of the switch.

The switch housing comprises a metal shell generally designated 50, and the insulation bottom or base 22 previously referred to. The latter is preferably a stamping of phenolic laminate. The shell 50 may be formed of a single piece of stamped sheet metal, and includes a top plate 52 which is slotted at 54 to receive and accommodate horizontal movement of the knob 14. The top plate 52 also has ears 56 apertured at 58 for mounting the switch. The shell further includes side walls 60 and 62 bent downwardly from the top plate 52. The insulation base 22 is preferably a flat piece of insulation material which is received between or across the side walls of the shell, and the said side walls and base preferably have interlocking parts to hold them in assembled relation.

More specifically, in the present case the side wall 60 has tongues 64 and the side wall 62 has inwardly bent lugs 66. These parts are received in mating notches at the side edges of base 22. Eventually the tongues 64 are bent inward and become inturned lugs like the lugs 66, and this is shown at 64'. However, initially they preferably are resilient tongues best shown in Fig. 5, in order to facilitate assembly of the parts of the switch. With the arrangement shown, after placing the handle, pad, and slide in an inverted shell, the base with its terminals is slid beneath lugs 66 and snapped into engagement with the tongues 64. The snap engagement is adequate to hold the parts assembled against the preloading of the resilient pad, until the switch reaches another work station where the tongues are forced over to final position 64'.

The terminals may be made in different ways, but the preferred form of terminal here shown is stamped out of sheet metal. Each terminal comprises a soldering tail 70 (Fig. 5), a fastening lug 72, and an upwardly convex contact portion 30 extending between and formed integrally with tail 70 and lug 72. The insulation base 22 is provided with a pair of parallel slots 74 and 76 to receive the tail 70 and lug 72, respectively. It will be evident from inspection of Fig. 6 that the terminal is slid through the slots while the lug 72 is still in its initial position 72' shown in dotted lines in Fig. 6, and that thereafter the lug is bent sidewardly against the bottom of the base as shown in solid lines.

Referring now to Fig. 2, it is convenient to reverse the position of alternate terminals when there is a single line of terminals for a single pole switch. Thus, the terminal 24 has its soldering tail 70 on one side, the terminal 26 has its soldering tail on the opposite side, and the terminal 28 has its soldering tail back on the first side. This increases the spacing between adjacent soldering tails when soldering wires thereto. In addition, the tails may be bent away from one another to further increase the transverse spacing therebetween.

The switch may be made as either a single pole switch or a double pole switch with very little change in the parts needed. Referring to Figs. 2 and 5, it will be seen that there are four collateral lines of slots, with three slots in each line. In the single pole switch the slots 78 at the one side are not used, and the slots 80 at the other side are not used. Only the two middle lines of slots are used for the terminals. In contrast, reference may be made to comparable Figs. 6 and 7, in which it will be seen that for a double pole switch two lines of terminals are provided, as shown at 82 and 84 in Fig. 6. Their soldering tails are shown at 86 and 88 in Figs. 6 and 7, and it will be seen that three of the terminals are anchored in the two lines of slots at one side of the base, while the other three are anchored in the two lines of slots on the other side of the base. In this case the alternate terminals at one side are not reversed, and instead the tails are all disposed toward the outside. For this construction the spacing between the four lines of slots must be uniform if all contacts are to be alike.

The single pole switch employs a single metal slide 20 as previously described. The double pole switch employs two collateral metal slides indicated at 92 and 94 in Fig. 6. Because the pad is itself an insulator, a single resilient pad 18 may extend across both slides, as is best shown in Fig. 8 of the drawing. The two metal slides are alike, and may be the same as the single slide used in the single pole switch. The terminals are the same in both cases. The metal shell and the insulation base are also the same in both cases.

The molded handle undergoes a change which is best shown in Figs. 3 and 4 of the drawing, referring to which it will be seen that looking from the bottom, the body 16 for the single pole switch has pockets 44 and 46 for the upwardly turned ends of a single metal slide, whereas in Fig. 4 the body 96 for the double pole switch has pockets 98 and 100 for one metal slide, and pockets 102 and 104 for a second metal slide. The pockets 34 for the resilient pad are relatively long and receive the same resilient pad in either case, the said pad being long enough to bear against both slides. However, if desired two separate short pads may be used in the double pole switch, and one of the same short pads in the single pole switch. In such case the slots 34 receiving the upper edges of the pads are appropriately altered to fit the pads.

In passing, it may be mentioned that in manufacturing the molded handle, the same mold may be used for either the single polt or double pole handle, it being necessary to change only an insert in the mold which forms the pockets for the ends of the slides.

In Figs. 1, 5 and 6 attention is directed to the small convex protuberances 106 molded at the top of the handle body 16 at the four corners thereof, and 107 at the bottom. These are of advantage in minimizing sliding friction between the top of body 16 and the bottom of the metal shell, and between the bottom of the slide and the top of the base. The same protuberances are formed at the top and bottom of the body 96 for the double pole switch shown in Fig. 6. The top of the knob 14 is preferably roughened or serrated as shown at 108 in Figs. 1, 5 and 6.

The particular slide switch shown is quite small, the housing being only one-quarter inch high, seven-sixteenths inch wide, and three-quarter inch long. The pad is neoprene having a hardness of 50 durometers. It is preloaded to compress it $^{15}/_{1000}$ of an inch and the downward fulcrum of the slide has a height of $^{20}/_{1000}$ of an inch. The contacts and the slide are preferably made of hard copper (e.g. No. 4 Brown and Sharpe). With the contacts and slide silver plated to a thickness of $^{1}/_{1000}$ of an inch, the carrying capacity of the switch at 120 volts is 3 amperes rated (5 amperes actual). For a less expensive switch of smaller carrying capacity the silver plating may be omitted.

It is believed that the construction and method of assembly of the present improved electrical switch, as well as the advantages thereof, will be apparent from the foregoing detailed description. It will also be apparent that while I have shown and described the invention in several preferred forms, changes may be made in the structures shown without departing from the scope of the invention as sought to be defined in the following claims. In the claims, for convenience of description, the switch is assumed to be disposed with its mounting plate in horizontal position, so that the movable parts move horizontally, but it will be understood that in practice the switch may be mounted vertically or in any desired position without affecting the operation thereof.

I claim:

1. An electrical switch comprising a horizontally slid-

able insulation handle having an upwardly projecting knob and a body, a resilient means carried by and beneath said body, a generally horizontal metal slide carried by and beneath said resilient means and body, an insulation base, and three spaced terminals mounted in stationary position on said base beneath said slide, said terminals being upwardly convex and said slide having a downward bump at one point, the dimensioning and spacing of the parts being such that in one position of the handle the slide overlies and bears downwardly on an end and a center terminal with the bump therebetween, and in the opposite position of the handle the slide overlies and bears downwardly on said center terminal and the other end terminal with the bump therebetween, said base having four collateral lines of slots with three slots in each line, said terminals comprising a soldering tail passing through one slot, a fastening lug passing through an adjacent slot, and a contact portion on top of the base between the tail and lug, the spacing of the lines of slots being uniform so that three terminals fit in the two middle lines of slots for a single-pole switch, and three terminals fit in the slots at one side of the base and three in the slots at the other side of the base for a double-pole switch.

2. An electrical switch comprising a horizontally slidable insulation handle having an upwardly projecting knob and a body formed integrally with said handle, a resilient pad carried by and beneath said body, a generally horizontal metal slide carried by and beneath said pad and body, and three spaced terminals mounted in stationary position beneath said slide, said terminals being upwardly convex, said slide being downwardly convex at a point beneath the resilient pad, the dimensioning and spacing of the parts being such that in one position of the handle the slide overlies and bears downwardly on an end and a center terminal with the pad therebetween, and in the opposite position of the handle the slide overlies and bears downwardly on said center terminal and the other end terminal with the pad therebetween, said resilient pad comprising a channel shaped piece of synthetic rubber, said piece being disposed transversely of the slide with its convexed lower end received in a mating concavity in the slide above the downward convexity of the slide, the concavity of the slide being serrated and the bottom of the pad being matingly serrated, and the pad being so dimensioned that it is compressed and thereby preloaded when the switch is assembled.

3. An electrical switch comprising a horizontally slidable insulation handle having an upwardly projecting knob and a generally horizontal body, a resilient means carried by and beneath said body, a generally horizontal metal slide carried by and beneath said resilient means and body, and an insulation base with three spaced terminals mounted in stationary position beneath said slide, at least the center one of said terminals being upwardly convex and said slide having a downward fulcrum bump at one point, said point being directly beneath the line of force of said resilient means, the dimensioning and spacing of the parts being such that in one position of the handle the slide overlies and bears downwardly on an end and a center terminal with the bump therebetween, and in the opposite position of the handle the slide overlies and bears downwardly on said center terminal and the other end terminal with the bump therebetween, said slide being abruptly tilted by the downward pressure of the resilient means as the fulcrum bump rides over the center terminal, thereby minimizing arcing between the slide and the end terminals, and said body and slide having means whereby the body engages the ends of the slide to move it regardless of the tilt of the slide.

4. An electrical switch comprising a horizontally slidable insulation handle having an upwardly projecting knob and a generally horizontal body formed integrally with said handle, a resilient pad carried by and beneath said body, a generally horizontal metal slide carried by and beneath said pad and body, and an insulation base with three spaced terminals mounted in stationary position beneath said slide, at least the center one of said terminals being upwardly convex, said slide being downwardly convex at a fulcrum point beneath the resilient body, the dimensioning and spacing of the parts being such that in one position of the handle the slide overlies and bears downwardly on an end and a center terminal with the pad therebetween, and in the opposite position of the handle the slide overlies and bears downwardly on said center terminal and the other end terminal with the pad therebetween, said slide being abruptly tilted by the downward pressure of the pad as the slide fulcrum rides over the center terminal, thereby minimizing arcing between the slide and the end terminals, and said body and slide having means whereby the body engages the ends of the slide to move it regardless of the tilt of the slide.

5. An electrical switch as defined in claim 4, in which the resilient pad comprises a channel shaped piece of synthetic rubber, said piece being disposed transversely of the slide with its convexed lower end received in a mating concavity in the slide above the downward convexity of the slide.

6. An electrical switch as defined in claim 4, in which the lower end of the resilient pad is received in a mating concavity in the slide above the downward convexity of the slide, and in which the concavity of the slide is serrated and the bottom of the pad is matingly serrated.

7. An electrical switch as defined in claim 4, in which the resilient pad comprises a channel shaped piece of synthetic rubber, said piece being disposed transversely of the slide with its convexed lower end received in a mating concavity in the slide above the downward convexity of the slide, and in which the concavity of the slide is serrated and the bottom of the pad is matingly serrated, and in which the pad is so dimensioned that it is compressed and thereby preloaded when the switch is assembled.

8. An electrical switch as defined in claim 3, in which the slide is formed of a strip of metal the ends of which are turned upwardly and received in pockets in the bottom of the handle, the parts being so dimensioned that the upturned ends of the slide insure horizontal movement of the slide with the handle, but said pockets being large enough above the ends of the slide not to interfere with the desired tilting action of the slide.

9. An electrical switch as defined in claim 4, in which the slide is formed of a strip of metal the ends of which are turned upwardly and received in pockets in the bottom of the handle, the parts being so dimensioned that the upturned ends of the slide insure horizontal movement of the slide with the handle, but said pockets being large enough above the ends of the slide not to interfere with the desired tilting action of the slide.

10. An electrical switch as defined in claim 4, in which the base has four collateral lines of slots with three slots in each line, and in which the terminals comprise a soldering tail passing through one slot, a fastening lug passing through an adjacent slot, and a contact portion on top of the base between the tail and lug, the spacing of the lines of slots being uniform so that three terminals fit in the two middle lines of slots for a single-pole switch, and three terminals fit in the slots at one side of the base and three in the slots at the other side of the base for a double-pole switch.

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