United States Patent

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[33] **Germany**
[31] **P 18 15 299.9**

[54] **SLIDE SWITCH**
13 Claims, 16 Drawing Figs.

[52] **U.S. Cl.** ..... **200/16 R,** 200/168 C
[51] **Int. Cl.** **H01h 15/00**
[50] **Field of Search** ..... 200/163, 16 R, 5 R, 168 C, 168 B

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Primary Examiner—D. F. Duggan
Assistant Examiner—Mark O. Budd
Attorney—Stowell and Stowell

ABSTRACT: In a slide switch: a housing defining chamber; a slide movably supported by said housing within said chamber and fixedly carrying contact elements; said housing being composed of two pairs of elements, a first pair and a second pair; the elements of each one pair being identical but different from those of the other pair; the elements of the second pair being arranged between the marginal portions of said elements of the first pair; said elements of the first pair having inwardly projecting spring arms provided with surfaces engaging mating surfaces of said elements of the other pair and holding said elements of both pairs together as a rigid unit; elongated contacts supported on said marginal portions of the elements of the first pair and each having a resilient middle portion bridging the space between said marginal portions and adapted to resiliently engage said contact elements fixedly carried by the slide.

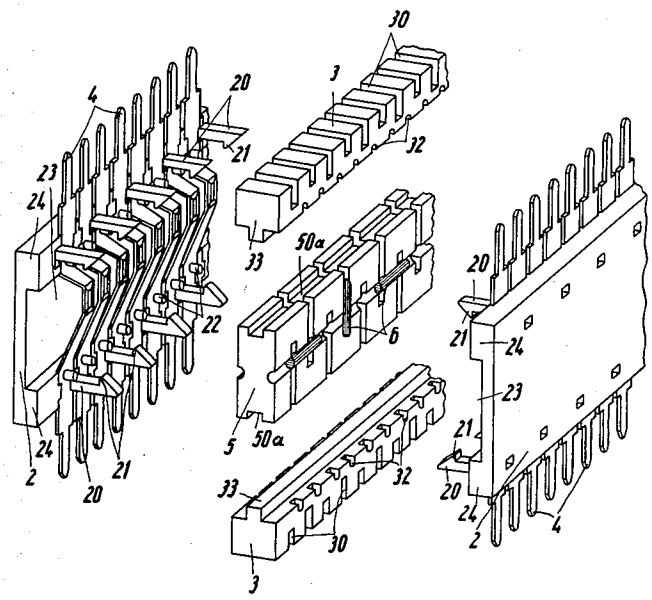

Fig. 1

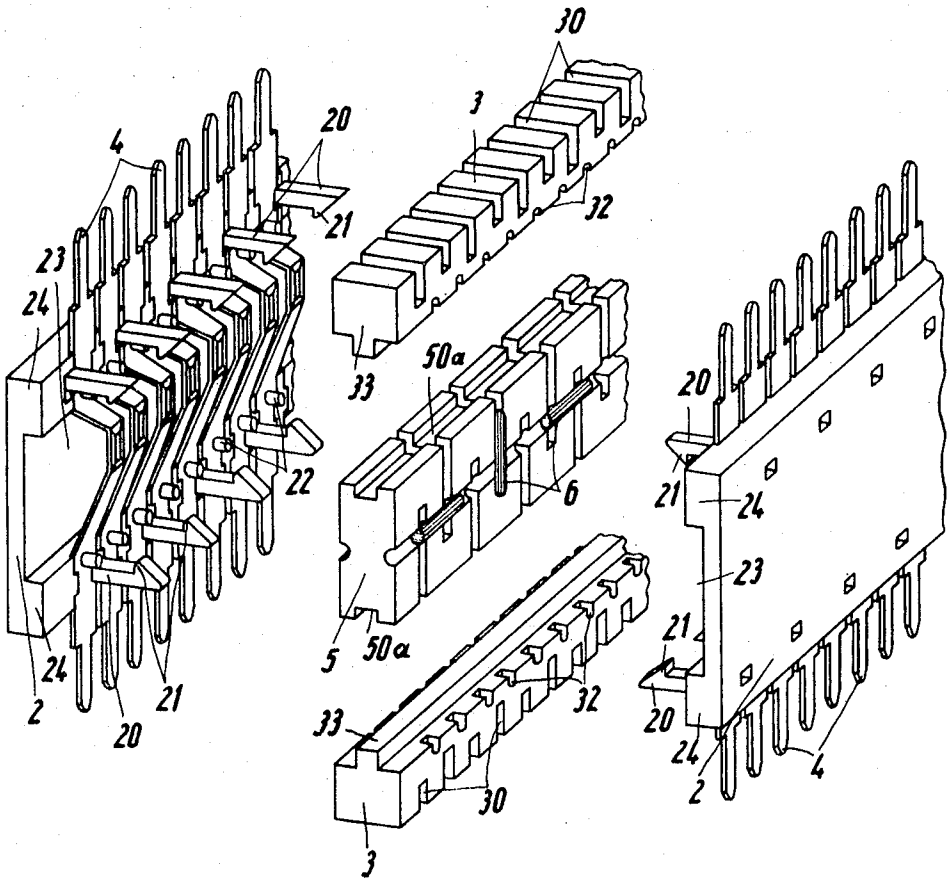
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Fig. 2

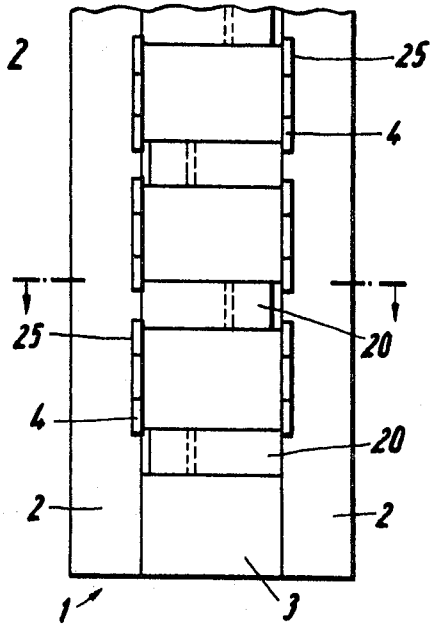
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Fig. 3

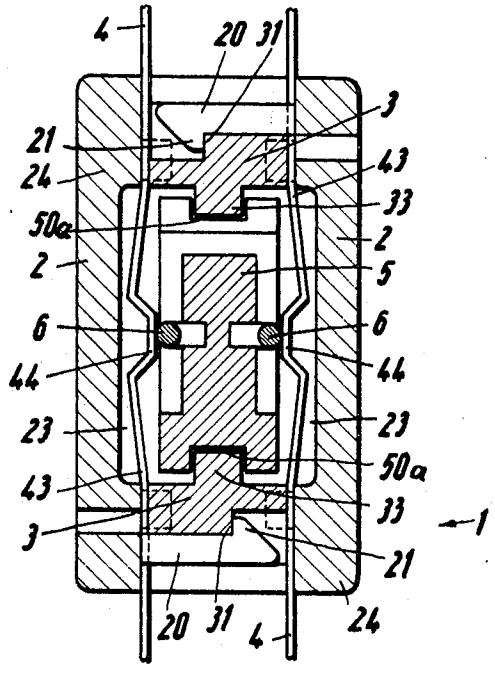
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Fig. 4

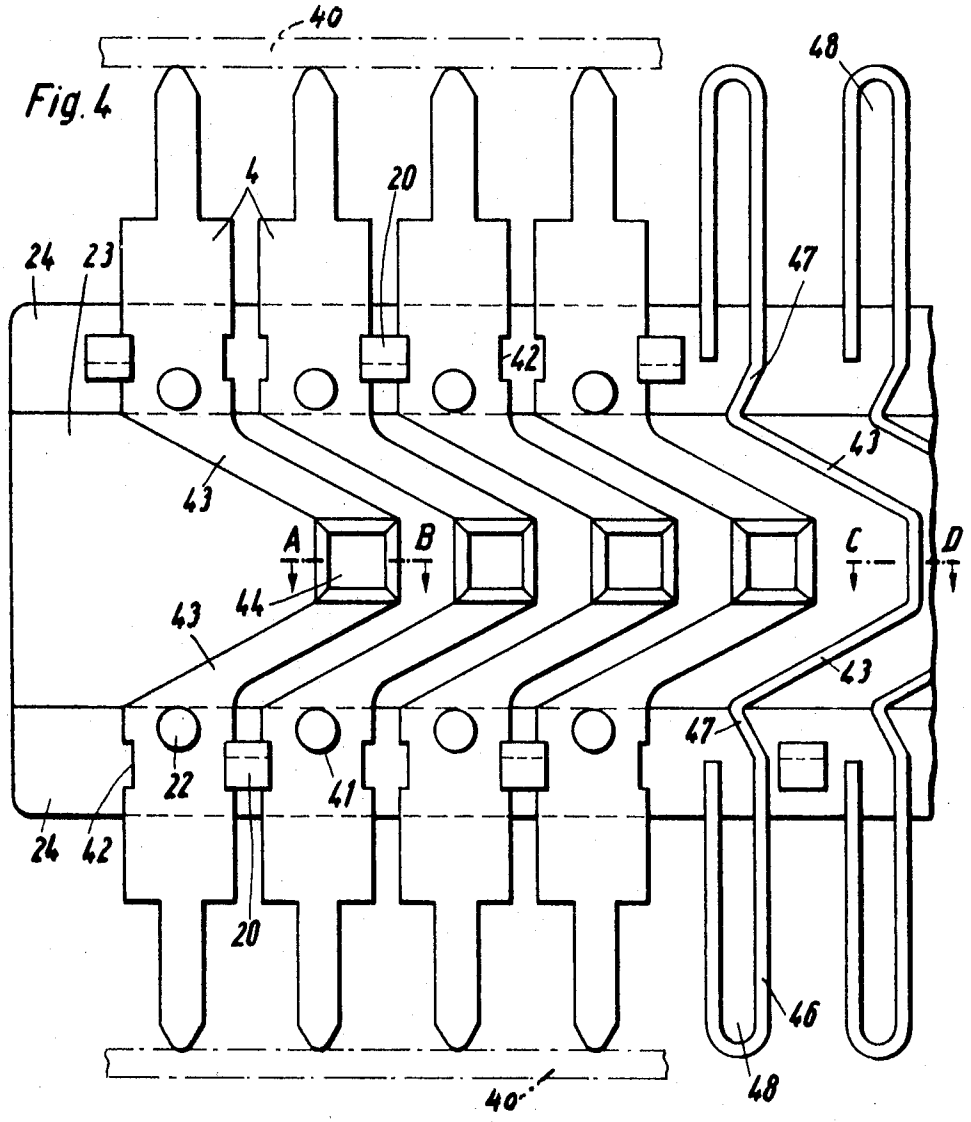


Fig. 5
(A-B)

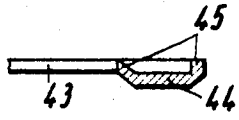


Fig. 6
(C-D)

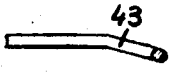


Fig. 7

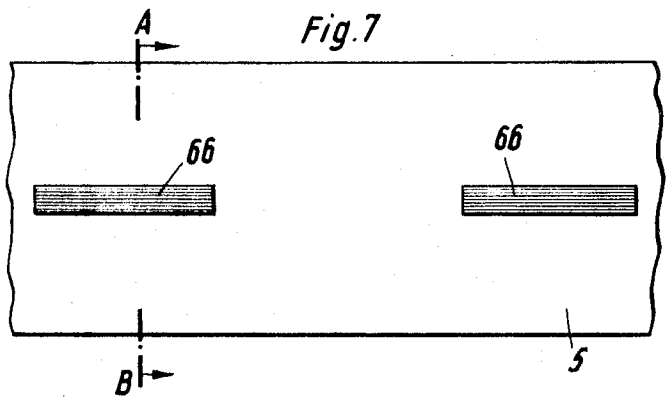


Fig. 8
(A-B)

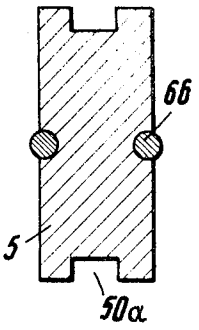


Fig. 9

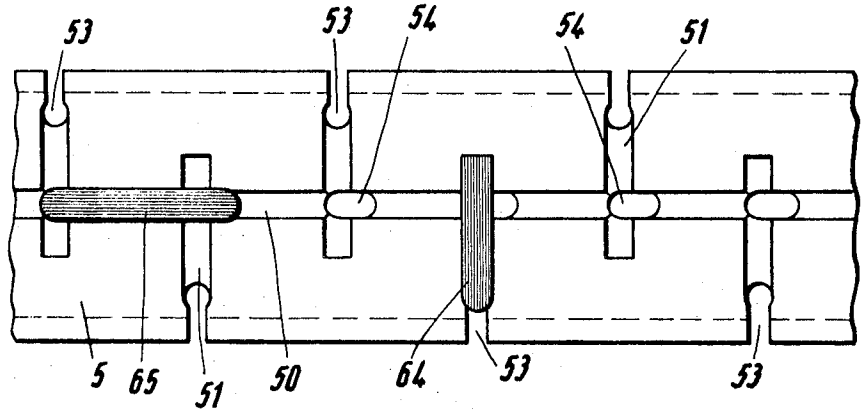


Fig. 10

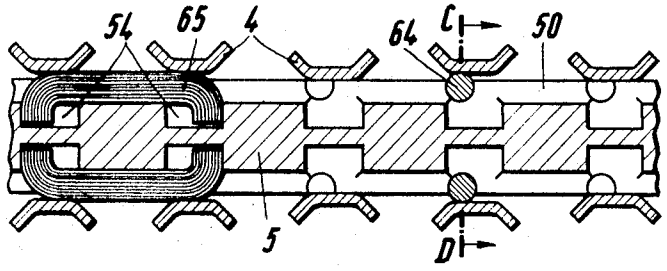


Fig. 11
(C-D)

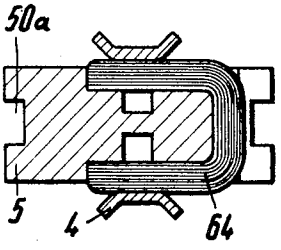


Fig. 12

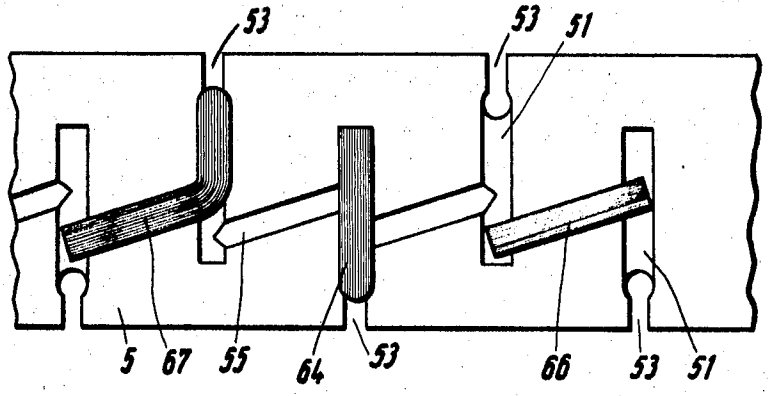


Fig. 13

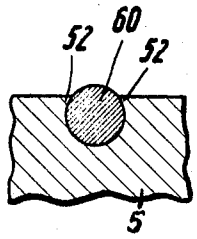


Fig. 14

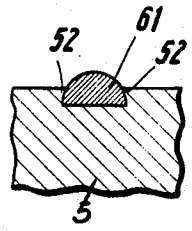


Fig. 15

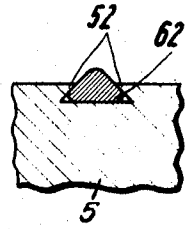
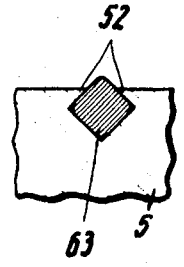


Fig. 16



SLIDE SWITCH

The invention relates to a slide switch having a switch slide element formed of insulating material, said slide element being provided on opposite surfaces with substantially rectilinear shaped contacts and being slidable in a chamber of a housing of insulating material said housing being composed of several individual parts; said slide element and said housing being provided with mutually engaging grooves and being adapted to guide the slide element within the housing; said housing carrying resilient contacts arranged opposite each other and engaging the contacts of the slide element.

In a known slide switch, fixed contacts are provided in a chamber of the housing on both sides of a switch slide and the switch slide has the shape of a flat frame carrying contact springs. The contact springs are arranged between the shorter margins of the switch slide and their ends are fastened in the region of the outer parts of the frame-shaped switch slide whereas the other, free ends are arranged in the direction of the middle axes of the slide in such a manner that they abut the fixed contacts of the chamber.

In this construction, the resilient contacts and the stationary or fixed contacts are embedded into the frame slide or the chamber part, respectively, both consisting of thermoplastic material, so that no separate attachment means are necessary. The tools for die-casting the frame element and the chamber element must however satisfy very high requirements because part only of the previously inserted contacts are allowed to be surrounded by insulating material after the die-casting process. This leads to a considerable increase of the costs and the tools are moreover not usable for different contact arrangements.

Another known slide switch, in which the switch slide consists of a strip-shaped element of insulating material and has contacts attached to the surface of the slide, the switch slide is moveable in a frame of insulating material provided with resilient contacts. The insulation frame is formed of two halves put together in a direction perpendicular to the surface of the strip-shaped switch slide and provided with means for attachment of the contact springs. The contact springs are strips and at the side of each of the contact springs there is at least one metal strip extending nearly parallel to the spring and forming with the latter one integral part. Though this slide switch permits closing circuits between opposite contacts in addition to the switching over of current circuits in operating direction, the method of manufacturing such a switch slide is very costly. In this slide switch it is also disadvantageous that the fixed contacts on the switch slide as well as the contact springs fastened on the insulating frame are of large area so that the switch is not suitable for switching high-frequency current circuits on account of the capacity between the contacts.

Another object of the invention is the provision of a switch slide which is so configured that the contacts carried thereby may be varied for different requirements.

A still further object of the invention is the provision of slide switch having a very narrow design and being adapted for automated manufacturing methods.

A slide switch designed according to the present invention comprises a chamber portion composed of four connectable and essentially bar-shaped elements, wherein oppositely arranged bar-shaped elements are identical in form and the connection between those elements arranged vertically to each other is effected by resilient arms and projections extending vertically to said arms in such a manner that the arms, which are integrally formed on the opposite elements, alternate with the projections formed on these elements and engage recesses between the opposite elements, and in which the common surfaces of contact of the elements arranged vertically to each other are provided for the fixation of resilient electric contact elements extending through the chamber portion with matching projections and recesses, and in which the portion of each contact element arranged in the hollow interior of the chamber portion if free and comprises in its middle a section coacting with line-shaped electric contacts of the switch slide,

said middle section being formed by resilient parts enclosing an acute angle with each other, being arranged in a plane located approximately parallel to the line-shaped fixed contact elements and serving for the connection of the contact elements.

In accordance with one embodiment of the invention, the resilient contacts are made of suitable metal strips as stampings wherein the section adapted to coact with the opposite contacts have an approximately square face, the free edges of the contact face being directed away from the contact face.

According to another aspect of the invention, a series of resilient contacts for one chamber portion may be manufactured of one common metal strip and be initially held together by two marginal portions adapted for later separation from the resilient contacts.

One embodiment according to the present invention includes resilient contacts of bent wire sections, wherein the sections serving for securement each include a portion of a right angle with the resilient section between them. The wire sections extending beyond the chamber may be formed into a loop and may end in the chamber element.

According to a further embodiment of the present invention, the line-shaped contacts are secured in recesses of the switch slide in such a manner that the longitudinal sides of the recesses provide resilient projections which embrace the region of largest cross-sectional width of the fixed contacts. The contacts of the switch slide may herein be provided with a circular, semicircular, triangular, or rhombic cross section.

Further embodiments according to the present invention relate to the arrangement of the recesses of the switch slide, which receive the line-shaped contacts. These may extend in each case on both sides of the switch slide over the entire length or they may be subdivided and arranged one behind the other in the direction of the sliding movement or they may extend at an angle or parallel to each other.

So as to permit closing of current circuits vertically to the direction of sliding movement, the invention may be further developed so that the recesses for the line-shaped contacts are arranged vertically to the direction of sliding movement and may be connected in pairs by recesses arranged vertically to the direction of movement in the narrow side of the switch slide. These recesses extending vertically to the direction of operation may be provided in addition to the recesses extending essentially in the direction of sliding movement.

Finally, one embodiment of the invention consists therein that the recesses, which extend vertically to the direction of sliding movement are provided in the narrow side of the switch slide alternately relative to each other in both narrow sides.

The details of the invention will be more fully understood and further objects, features and advantages thereof will become apparent from the embodiments illustrated on an enlarged scale in the attached drawings and described in the following.

In the drawings:

FIG. 1 illustrates an exploded perspective view of a switch slide made according to one embodiment of the present invention;

FIG. 2 is a fragmentary plan view of the switch shown in FIG. 1 after having assembled the various parts with one another;

FIG. 3 is a section along line 3—3 of FIG. 2; FIG. 4 is a fragmentary view of one of the housing elements revealing the spring contacts attached thereto;

FIGS. 5 and 6 are fragmentary views, partly in section along lines A–B and C–D of FIG. 4;

FIG. 7 is a fragmentary side elevation of a switch slide;

FIG. 8 is a section along line A–B in FIG. 7;

FIG. 9 is a fragmentary view of another embodiment of a switch slide;

FIG. 10 is a longitudinal section through the switch slide according to FIG. 9;

FIG. 11 is a section along line C–D in FIG. 10;

FIG. 12 is a side elevation of a still further embodiment of the switch slide; and

FIG. 13 through 16 are cross sections through different embodiments of rectilinearly shaped rectilinearly contacts and of fragments of adjoining portions of the switch slide.

The illustrated slide switch consists of a chamber portion 1 in the interior of which the switch slide 5 is slidable. Slide 5 carries contacts 6 and is slidable essentially parallel to the spring contacts 4 extending through chamber portion 1. Chamber portion 1 is composed of two pairs of essentially bar- or lath-shaped elements 2, 3, the opposite elements 2,2 or 3,3, respectively, of each pair being identical. The connection between the elements 2,3, is effected by resilient arms 20 integrally formed on the elements 2. Arms 20 have projections 21 which reach behind edges 31 provided in channel shaped recesses 30 of the elements 3. The elements 2 comprise studs 22 in addition to the arms 20, these studs engaging recesses 32 of the elements 3. Moreover, the elements 2 are provided in their midregion with a channel-shaped recess 23 so that in this region the bridging sections 43 of the spring contacts 4 may be permitted to move in a direction perpendicular to the longitudinal direction of chamber portion 1.

Spring contacts 4 re inserted in recesses 25 adapted to the material thickness of the spring contacts 4 and provided on the step-shaped projections 24. The spring contacts 4 are secured against displacement by studs 22 which engage recesses 41 of the spring contacts 4, and by the arms 20 which cooperate with the recesses 42 of the spring contacts 4. The spring contacts, inserted into the elements 2, may be manufactured by die-cutting out of a common metal plate and be connected by two severable marginal parts 40 shown in dot-and-dash lines in FIG. 4. The spring contacts 4 extend on one side or on both sides beyond the chamber part 1 and are adapted for insertion into a correspondingly perforated printed circuit plate (not shown). The sections of the spring contacts 4 which bridge recess 23 in part 2 are V-shaped, the spring arms 43 ending near their common apex in contact surface 44. Surface 44 is essentially square and its margins 45 are rearwardly bent away from the contact surface 44.

Spring contacts 4 may also be produced of wire sections 46. In this, the spring arms 43 enclose a right angle with the adjoining sections 47 serving for the attachment of the springs. The wire sections projecting beyond the chamber part 1 may be bent into a soldering ear 48 and end in the chamber portion 1. The use of spring contacts formed of wire sections is recommendable when the contact surfaces between the spring contacts 4 and the line-shaped contacts 6 of the switch slide should be point-shaped.

Switch slide 5, carrying the contacts 6, is provided on its narrow side surface with one channel-shaped recess 50*a* which cooperates with ridge 33 formed on element 3 of the chamber element 1 for guiding the switch slide 5. The line-shaped contacts 6 consist of wire sections which may have an essentially circular cross section 60, a semicircular cross section 61, a triangular cross section 62, or a rhombic cross section 63, respectively, as illustrated in FIGS. 13 through 16.

Securement of contacts 6 on which slide 5 is effected by recesses 50, 51 in slide 5, which recesses are adapted to the cross section of the respective wire sections and so shaped that the greatest width of the wire sections is embraced along the longitudinal margins of recesses 50, 51 by resilient projections 52 provided along the margins of said recesses 50, 51. The recesses 50, 51 for the reception of contacts 6 are provided on both sides of the switch slide 5 essentially in the direction of movement (recesses 50) and vertically to this movement (recesses 51). The recesses 51 extending perpendicular to the direction of operation are interconnected in pairs by recesses 53 extending through the narrow sides of switch slide 5. The recesses 53 are, in this case, preferably arranged alternately opposite to one another in the narrow sides of the switch slide 5.

U-shaped wire sections 64 are insertable into the recesses 51 so that they provide a conductive connection between oppositely arranged spring contacts 4.

The recesses 50 of switch slide 5 may be adapted to the length of the contacts to be inserted as shown in FIGS. 7 and 12, or the recesses 50 may extend over the entire length of the switch slide 5 as shown in FIGS. 9 and 10. The contacts are formed as wire sections 65 with rectangularly bent off ends, the ends engaging the recesses 54 for securement against displacement. The recesses adapted to the length of the insertable contacts may be arranged one behind the other (FIG. 7) or may extend at an angle to the direction of movement or parallel to one another (FIG. 12). The insertable contacts are wire sections 66, the contact surfaces of which are inclined at the ends so as to allow the spring contacts 4 to slide onto the fixed contacts 66. Arrangement of the recesses 55 at an angle to the direction of movement has the advantage that the inserted wire sections 66, slide upon movement of switch slide 5, over the entire contact surface 44 of the spring contacts 4, so that this contact arrangement has a relatively long life span. In FIG. 12 there is also shown a contact 67 which is formed on one side of the switch slide 5 in the direction of movement and is formed on the opposite side perpendicular to the direction of movement.

What is claimed is:

1. In a slide switch: a housing defining chamber; a slide movably supported by said housing within said chamber and fixedly carrying contact elements; said housing being composed of two pairs of elements, a first pair and a second pair; the elements of each one pair being identical but different from those of the other pair; the elements of the second pair being arranged between the marginal portions of said elements of the first pair; said elements of the first pair having inwardly projecting spring arms provided with surfaces engaging mating surfaces of said elements of the other pair and holding said elements of both pairs together as a rigid unit; elongated outer contacts supported on said marginal portions of the elements of the first pair and being abutted by marginal surfaces of said second pair, the outer contacts each having a resilient middle portion bridging the space between said marginal portions and resiliently engaging said contact elements fixedly carried by the slide.

2. The slide switch according to claim 1 wherein the outer resilient contacts have midsections making an acute angle with each other, meeting at and defining a contact surface.

3. The switch according to claim 1 wherein the outer resilient contacts are formed as punched out sheet parts and wherein said outer contact surfaces are square shaped where they are abutted by said slide carried contact elements, the margins of said square contact surfaces being bent off away from the contact surface.

4. The switch according to claim 1 in which the outer contacts are formed from wire sections.

5. Switch according to claim 1 in which said slide carried fixed contacts are secured in recesses in the slide by resilient projections fitting into the margins of the slide recesses.

6. The switch according to claim 5 in which said slide carried contacts are of wire and have essentially circular, or semicircular, or triangular, or rhombic cross sections.

7. The slide switch of claim 3 wherein each of said first pair of elements is provided along its marginal portions with studs integrally projecting therefrom, said studs passing through complementary recesses in said outer contacts.

8. The slide switch of claim 1 wherein each of the said first pair of elements is channel-shaped in transverse cross section, to thereby permit bending movement of the midportions of the said outer contact elements, and wherein each of said second pair of elements is provided with a ridge slidably engaging a complementary slot in the narrow, lengthwise surface of said slide.

9. The switch according to claim 5 in which said switch slide is rectangular in cross section and is provided on both its two narrow sides with a recess extending over the entire length of said slide.

10. The switch according to claim 5 in which said switch slide is rectangular in cross section and is provided on both its

two widest sides with several contact carrying recesses extending in the direction of movement of said slide and being arranged in rows.

11. The switch according to claim **5**, in which said switch slide is rectangular in cross section and is provided on both its two widest sides with several contact carrying recesses extending at an angle to the direction of movement of the switch slide and parallel to one another.

12. The switch according to claim **5**, in which said switch slide is rectangular in cross section and said recesses are arranged on both widest sides perpendicular to the direction of movement of said switch slide and which are interconnected in pairs by recesses extending perpendicular to the direction of movement in the narrow sides of said switch slide, all the said recesses carrying contacts.

13. Switch according to claim **12**, in which said recesses are arranged perpendicular to the direction of movement in the narrow side of said switch slide and in which said recesses are arranged alternately to one another with respect to the narrow sides of said slide.

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