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Van Der Donk

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[54] **ALTERNATE MAKE-BREAK TYPE SLIDE SWITCH WITH IMPROVED MOVABLE CONTACT**

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[30] **Foreign Application Priority Data**

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[51] **Int. Cl.** **H01h 13/56,** H01h 1/44

[58] **Field of Search** ..... 200/16 C, 16 D, 153 J, 200/166 BH, 168 K, 159 R, 252, 257, 275, 200/279, 280, 303, 328, 338,340

[56] **References Cited**

UNITED STATES PATENTS

3,242,273	3/1966	Van Der Put	200/303 X
3,399,282	8/1968	Nagashima et al.	200/16 D X
3,567,891	3/1971	Hinkelmann	200/166 BH
3,582,592	6/1971	Schadow	200/328 X
3,624,320	11/1971	Eberhart et al.	200/303 X
3,646,283	2/1972	Hansen	200/153 J X
3,665,127	5/1972	Lockard et al.	200/168 K X

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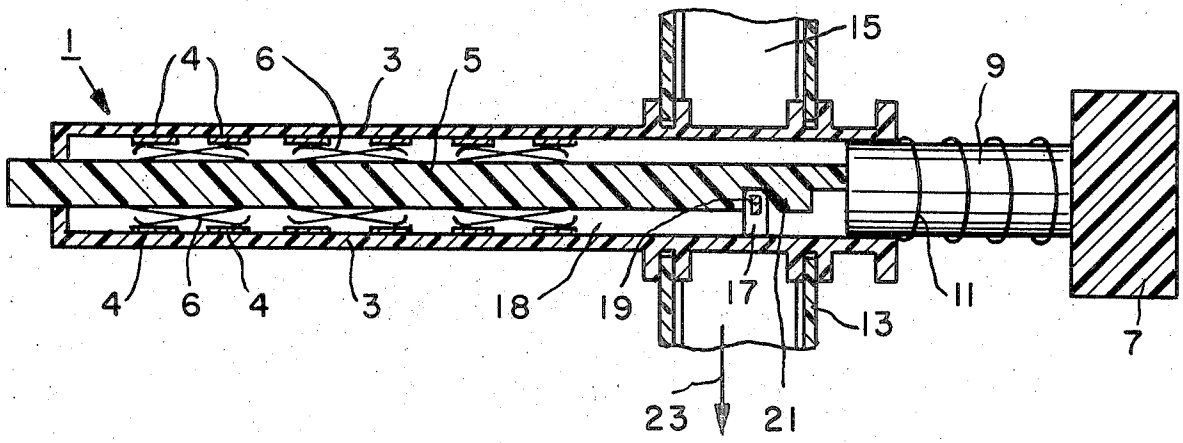
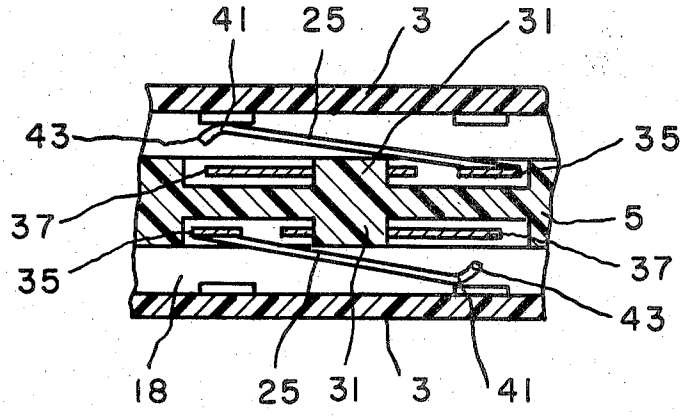
[57] **ABSTRACT**

A slide switch comprising a strip-like contact slide provided with movable contacts, each of which has two resilient fingers provided with contact areas. The fingers are connected, by connecting strips which act as torsion springs and which extend perpendicular to the fingers, to a centre part which has a central opening and which serves for connection on the contact slide.

10 Claims, 6 Drawing Figures





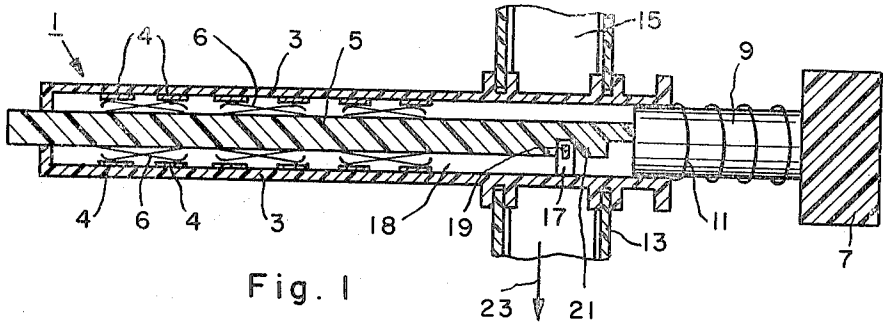


Fig. 1

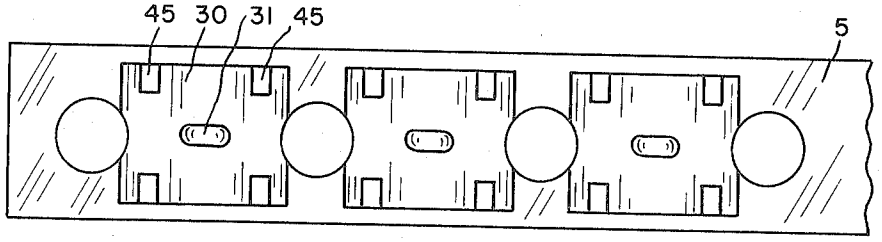


Fig. 2

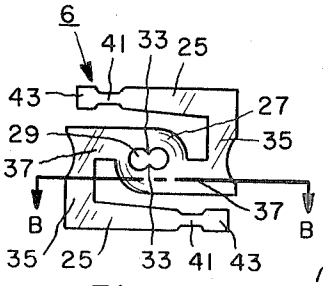


Fig. 3a

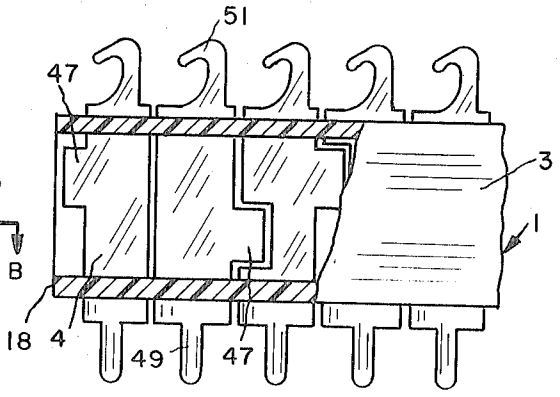


Fig. 4

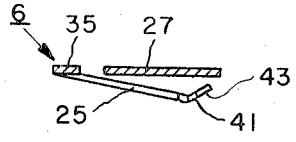


Fig. 3b

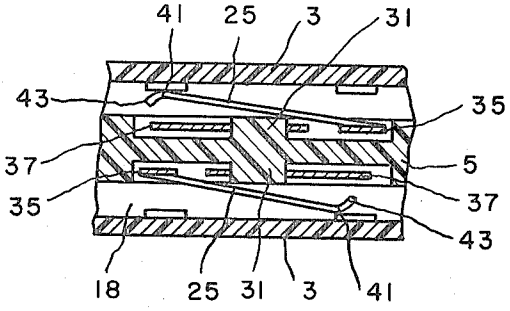


Fig. 5

ALTERNATE MAKE-BREAK TYPE SLIDE SWITCH WITH IMPROVED MOVABLE CONTACT

The invention relates to a slide switch comprising a strip-like contact slide which is provided with movable contacts and which is slidable in the longitudinal direction between two plates arranged parallel to the plane of the contact slide. These plates form the walls of a housing. Stationary contacts are provided on the walls to cooperate with the movable contacts. Each of the movable contacts comprise a pair of resilient fingers which are situated on both sides of a center part, which serves for the connection of the movable contact to the contact slide. The fingers form one integral unit of a plate-like material with the center part and are provided with a contact area near their free end.

The contact areas of the movable contacts must be pressed against the stationary contacts at an adequate pressure in order to ensure proper electrical connection. On the other hand, this pressure should not be too large because the movement of the contact slide will otherwise be impeded by friction. Because a slide switch is a mass produced item which is assembled in large quantities from preformed parts, these requirements must be satisfied in spite of unavoidable dimensional deviations. A requirement in this respect is that the movable contacts must have a flat resilience characteristic in their operating range, i.e., the resilience can only be dependent on the deformation of the spring to a small extent.

In a slide switch which is known from German Offenlegungsschrift 1,665,827, the resilience is obtained substantially exclusively by the bending of the resilient fingers. So as to achieve the required flat resilience characteristic, these fingers must be comparatively long, which opposes a further requirement which must often be satisfied by slide switches, i.e., the dimensions must be limited in view of the space available for building in the slide switch, for example, in a radio receiver.

The object of the invention is to provide a slide switch having movable contacts with the desired flat resilience characteristic, while the dimensions of the switch can be very small. To this end, the slide switch according to the invention is characterized in that each of the movable contacts comprises two connecting strips which extend approximately perpendicular to the longitudinal direction of the fingers. Each connecting strip connects the non-free end of a reed to an extension of that half of the center part which is situated near the other reed. The length of said connecting strips exceeds their width. The center part of the movable contact has a central opening which is slid over a pin projecting from the slide in order to connect this contact.

The connecting strips act as torsion springs, thus making a substantial contribution to the flattening of the resilience characteristic, without the dimensions of the movable contacts being significantly increased.

In order to increase the contact pressure, the resilient fingers, in a preferred embodiment of the slide switch according to the invention, are provided at the contact areas with a construction which reduces the contact area.

Slide switches are generally operated by a pushbutton by means of which a force acting in the longitudinal direction of the contact slide can be exerted on the contact slide, with the result that the latter is slid from a first to a second position. The contact slide can be

locked in the second position, a reset spring being provided for returning the contact slide to the first position after the slide has been released. With this kind of slide switch, the contact slide is first slid slightly beyond the second position when the pushbutton is depressed in order to ensure proper operation of the locking mechanism. When the pushbutton is released, the contact slide is pressed against the lock by the reset spring, with the result that it remains in the second position. Because the dimensions of the contacts are very small in the direction of movement of the contact slide in the slide switch according to the invention, it may occur that, when the contact slide is slid beyond the second position, the contact areas of the movable contacts are slid beyond the stationary contacts. As a result, an electrical connection would first be established which would subsequently be broken and then be re-established. This is often undesirable, and so as to prevent this phenomenon, a slide switch of this type is preferably characterized in that in the movement direction of the contact slide the dimension of the stationary contacts is larger at areas where they contact the movable contacts when the contact slide is in the second position than at other areas.

The invention will be described in detail with reference to the accompanying drawings, in which:

FIG. 1 is a plan view of the interior of a slide switch according to the invention,

FIG. 2 is a side elevation at an enlarged scale of a part of a contact slide of the slide switch shown in FIG. 1,

FIG. 3*a* is a side elevation of a movable contact for connection to the contact slide shown in FIG. 2,

FIG. 3*b* is a sectional view along the line BB of the movable contact shown in FIG. 3a, and

FIG. 4 is a side elevation of a partly broken open part of a housing for the slide switch of FIG. 1.

FIG. 5 is an enlarged sectional view of a portion of the slide switch shown in FIG. 1.

The slide switch shown in FIG. 1 comprises a housing 1, the walls of which are formed by two parallel plates 3 which are provided with stationary contacts 4, a strip-like contact slide 5 which is provided with movable contacts 6 arranged between the plates. The contact slide 5 can be slid in its longitudinal direction from a first position (the position shown in FIG. 1) to a second position (not shown) in which the contact slide has been displaced to the left with respect to the situation shown in FIG. 1. The displacement can be effected by depressing a pushbutton 7 which is connected to the contact slide 5 by way of a button rod 9. A reset spring 11 serves to ensure that the contact slide 5 returns to the first position when the pushbutton is released. The returning of the slide can be prevented by means of a locking mechanism which locks the contact slide 5 in the second position. Various embodiments of locking mechanisms of this kind are known. One of these embodiments is diagrammatically shown in FIG. 1.

In this embodiment the switch is slid into a cut-out in the upright walls of a trough-like connecting member 13, the longitudinal direction of which is perpendicular to the longitudinal direction of the switch. Arranged on the bottom of the connecting member 13 is a strip-like button lock 15 which is slidable in its longitudinal direction (denoted partly by broken lines). A pawl 19, associated with the button lock 15, projects through an opening 17 in the bottom 18 of the housing. When the

pushbutton 7 is depressed, a cam 21 which is formed on the slide 5 abuts against the pawl 19, so that the button lock 15 is moved in the direction of the arrow 23. After the cam 21 has passed the pawl 19, the button lock 15 slides back, under the influence of a spring (not shown), against the direction of the arrow 23, so that the cam 21 comes to rest against the pawl 19 when the pushbutton 7 is released, thus preventing the returning of the slide 5 to the first position. Unlocking takes place only when the button lock is again displaced over a sufficiently long distance in the direction of the arrow 23, for example, by depression of the pushbutton of a second switch (not shown) which is connected in the same manner to the connecting member 13.

Each of the movable contacts 6 (see also FIGS. 3*a* and *b*) comprises a pair of resilient fingers 25 which are arranged on both sides of a center part 27 which comprises a central opening 29 which serves for the connection of the contact on the contact slide 5. To this end, the contact slide 5, comprising a chamber 30 (see FIGS. 2 and 5) for each movable contact 6, is provided with a pin 31 in the center of each of these chambers. The circumference of the central opening 29 corresponds substantially to that of the pin 31, except that a number (two in the case shown) of inwards projecting teeth 33 are provided on the circumference of the opening. The material of the contact 6 (for example, phosphor bronze) is substantially harder than the material of the contact slide 5 (synthetic resin), so that the teeth 33 penetrate into the pin 31 when the contact 6 is connected on the contact slide. The contact 6 is thus prevented from coming loose from the contact slide 5, without an additional operation being required.

One end of each of the fingers 25 is connected, by a connecting strip 35, to an extension 37 of the center part 27 which, in order to increase the length of the connecting strip, adjoins the half of this center part which is situated near the other finger. Thus, with very small dimensions of the contacts, the length of the connecting strip 35 is larger than its width, so that the connecting strip can act as a torsion spring. Each of the fingers 25 furthermore comprises a contact area 41 which, after the mounting of the contact slide 5 in the housing, abuts against a stationary contact 4. In order to reduce the surface of this contact area, the finger 25 is provided with a constriction at the contact area. The contact pressure is thus increased. The contact pressure is delivered partly by elastic twisting of the connecting strip 35, and partly by the elastic bending of the finger 25. To this end the finger 25 is bent so far out of the plane of the center part 27 (see FIG. 3*b*) that it is bent slightly back again when the contact slide 5 is placed in the housing 1. In order to ensure that only the contact area 41 contacts the wall 3 of the housing 1, the free end 43 of the reed 25 is bent backwards in the direction of the center part 27. The contact slide 5 is provided with openings 45 in which this free end is movable. The complete movable contact 6 can be formed from one piece of plate-like material by way of a punching operation.

For the proper operation of a locking mechanism of the kind set forth, it is desirable that the contact slide 5 is slid slightly beyond the second position when the pushbutton 7 is depressed. This is necessary to ensure that the cam 21 indeed passes the pawl 19. However, because the dimensions of the described movable contacts may be very small in accordance with the present invention, so that the stationary contacts 4 may also be very small, the contact area 41 is liable to be pushed slightly beyond the stationary contact 4 during the depression of the pushbutton 7, so that an established connection is temporarily broken. So as to prevent this phenomenon, the dimensions of the stationary contacts 4 are larger at the areas 47 where they contact the movable contact 6 in the movement direction of the contact slide 5 than at the other locations. This is clearly illustrated in FIG. 4, which is a side elevation of a part of the housing 1 with a partly broken away sidewall 3, without the contact slide 5. The stationary contacts 4 consist of a metal coating of the synthetic resin wall 3. They are connected on the one side to soldering pins 49 for soldering the switch 2, for example, to a printed circuit board, and on the other side to hook-like soldering lugs 51 for the connection of connecting wires. Other connecting means are obviously also feasible.

What is claimed is:

1. A slide switch comprising a strip-like contact slide which is provided with movable contacts and which is slidable in the longitudinal direction between two walls of a housing, said walls being arranged to be parallel to the plane of the contact slide, and stationary contacts provided on said walls which cooperate with the movable contacts, each of the movable contacts comprising a pair of resilient fingers which are situated on both sides of a center part adapted to serve for the connection of the movable contact to the contact slide, said fingers forming one integral unit of a plate-like material with said center part, and being provided with a contact area near their free end, each of the movable contacts having two connecting strips which extend substantially perpendicular to the longitudinal direction of said fingers, each connecting strip connecting the non-free end of a finger to an extension of that half of the center part situated near the other finger, the length of said connecting strips exceeding their width, and a central opening in said center part which is slid over a pin projecting from the slide in order to connect said movable contact to said slide.

2. A slide switch as claimed in claim 1, wherein said fingers are provided with a constriction at the contact areas.

3. A slide switch as claimed in claim 1 wherein said central opening has at least one inwards projecting tooth which penetrates into the pin.

4. A slide switch as claimed in claim 1, in which the contact slide can be slid from a first to a second position by a force which acts in its longitudinal direction, locking means being provided to lock the contact slide in said second position, reset means being provided for returning the slide to its first position after unlocking, and wherein the dimension of the stationary contacts is larger at areas where they contact the movable contacts when the contact slide is in the second position than at other areas.

5. A slide switch comprising a housing having a wall defining a longitudinal direction, two stationary contact members carried on said wall within said housing, a strip-like slide mounted for longitudinal movement between first and second operative positions within said housing, a movable contact member carried on said slide for cooperative engagement with a stationary contact member, and means connected to said slide for causing longitudinal movement thereof, said mov-

able contact comprising a central part, means carried by said central part for attaching said movable contact to said slide, two extension members extending in diametrically opposed directions from said central part, a connecting strip extending from each of said extensions in opposite directions and substantially perpendicular to said extensions and having a length greater than its width, a pair of resilient fingers each connected at one end thereof to one of said connecting strips, said fingers extending in parallel opposed directions and being located on opposite sides of said central part, and a contact area carried on the free end of each of said fingers for contact with a stationary contact member, said central part and said pair of fingers being integrally formed of a substantially flat plate-like material.

6. The slide switch according to claim 5 further comprising a constriction at said contact area of each resilient finger so as to minimize the contact surface of said contact area.

7. The slide according to claim 5 further comprising a pin carried by said slide for receiving said movable contact, and wherein said means for attaching said movable contact to said slide comprises an aperture in said central part and at least one tooth projecting inwardly on said aperture for engaging said pin so as to securely hold said movable contact on said slide.

8. The slide switch according to claim 5 further comprising locking means for locking said slide in said second position, reset means for releasing said locking means for returning said slide to said first position, and enlarged contact areas carried by said stationary contacts for maintaining contact with said movable contacts when said slide is moved to said second position.

9. A slide switch comprising a housing having two spaced parallel walls, stationary contact members carried on said walls, a strip-like slide mounted within said housing for longitudinal movement between said walls, said strip-like slide being movable parallel to said walls, movable contact members carried on said slide for cooperative engagement with the stationary contact members, said movable contacts comprising a central part carrying means for connection to said slide, a pair of resilient fingers formed integrally with said central part, means integrally formed with said fingers and said central part connecting one end of each finger to said central part, said fingers oriented substantially parallel to each other being located on diametrically opposite sides of said central part and having free-ends extending in opposite directions, and a contact area carried on said free ends for contact with said stationary contacts.

10. The slide switch according to claim 9 wherein said means connecting said fingers to said central part comprises substantially L-shaped members having one leg thereof connected to the non-free end of one of said fingers and the other leg thereof connected to said central part, the leg connected to said fingers having a length greater than its width so as to form a torsional resilient member.

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