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Safety fuse switch

The present invention relates to a safety fuse switch with an insulating case in which two hot case contacts are arranged so as to be stationary and with a slide switch that is also made of insulating material and is slidably or pivotally guided in the insulating case between a switch-on position and a switch-off or replace position, a fuse cartridge being received therein, the caps of the end contacts of said fuse cartridge being directly adjacent the stationary case contacts when they are in the switch-on position and being held apart from the stationary case contacts when they are in the switch-off or in the replace position.

Safety fuse switches serve to connect in series a safety fuse cartridge into a current-carrying conductor so that the current flow in said conductor may be monitored by means of this safety fuse cartridge and may be interrupted through the melting of the fuse wire located in the cartridge when a maximum value, which can be predetermined, is exceeded.

The problem with the heretofore known designs of safety fuse switches often is that, when the slide switch is in the switch-off or replace position, access to the fuse cartridge is not easy and difficulties have been experienced in removing a broken, or inserting an intact, fuse cartridge.

DE-A1-24 37 509 describes a fuse disconnecting switch for HRC-fuses. A HRC bottom part is thereby provided, said bottom part having two contacts into which may be inserted the contact tabs of the fuse link. This fuse link is detachably fastened to a cover part which is slidably carried between two wall parts.

On the sides of the cover part there are formed driving pins that engage in slot-like guiding facilities worked into levers. Said levers are arranged laterally beside the cover parts and are carried on the wall parts in such a manner as to be pivotal about the axes.

Furthermore, projections having the shape of a quarter of an annulus are formed on the side faces of the cover part, said projections engaging slot-like guiding facilities worked into the wall parts. These guiding facilities approximately describe a J-shape.

On pivoting the levers (which may be carried out by way of the handle that joins the two levers together), the cover part is at first displaced along a straight line together with the HRC-fuse attached thereto, thus being pulled out of the contacts (compare Fig. 2 of **DE-A1-24 37 509**). When the position illustrated in Fig. 3, in which the driving pins stand next to the end of the guides, is reached and when the lever is pivoted further, the cover part and the fuse link are pivoted 90.degree. on account of the cooperation of the projections having the shape of a quarter of an annulus with the round portions of the guides (compare Figs. 3 and 4 of **DE-A1-24 37 509**). In this position which is pivoted through 90.degree., the fuse link is more easily accessible and can better be replaced.



It is the object of the present invention to indicate a safety fuse switch of the type discussed herein above in which the fuse cartridge is easily accessible in the sense that it may easily be removed by hand when the slide switch is in the switch-off or replace position.

The solution to this object is to provide a cradle that is slidably carried in the slide switch and holds the fuse cartridge, said cradle having a pin that engages into a coulisse arranged on the insulating case, said coulisse being shaped in such a manner that, when the slide switch is displaced or pivoted, the cradle is displaced relative to the slide switch so that a portion of the fuse cartridge extends beyond the slide switch.

The portion of the fuse cartridge that extends beyond the slide switch may easily be grasped by hand so that a fuse cartridge may be taken out of the slide switch or inserted there into without any problem. On account of the cooperation between pin and coulisse, the fuse cartridge is automatically brought into the easily accessible position as the slide switch is being displaced or pivoted, and there is no need for the user of the installation to undertake any steps in this connection, he merely needs to let the slide switch execute the unavoidable displacement or pivotal movement.

In a development of the invention there may be provided that at least one portion of the coulisse departs from the direction of displacement or pivotal movement of the slide switch.

The displacement of the cradle in accordance with the invention is thus achieved in a particularly reliable manner.

According to a particularly preferred embodiment of the invention there may be provided that the coulisse has two portions, the first portion being oriented toward the displacement or pivotal direction of the slide switch and the second portion departing from the displacement or pivotal direction of the slide switch.

As long as in this embodiment the pin is located in the first portion of the coulisse, there is no displacement whatsoever of the fuse cartridge relative to the slide switch. The case contacts are preferably arranged in such a manner that their longitudinal axis is oriented toward the displacement or pivotal direction. With such an arrangement of the case contacts, when the first portion of the coulisse is placed in such a manner that, immediately upon leaving the switch-on position, the pin passes there through, the fuse cartridge is pulled off the case contacts on the shortest possible way. Frictions of the fuse cartridge against the case contacts which lead to unnecessary wear of the case contacts are thus avoided.

In a development of this embodiment, there may be provided that the two portions of the coulisse are rectilinear and that the second portion is positioned at an angle ranging from 30 to 60.degree., preferably at an angle of 45.degree., to the direction of displacement of the slide switch.

As a result thereof, the coulisse is of a particularly easy to manufacture design that still serves the purpose in accordance with the invention.

In a particularly preferred embodiment of the invention that comprises a signal circuit which is arranged on the slide switch and comprises two connecting contacts and which is designed to indicate failure of the inserted fuse cartridge, each connecting contact being connected to a respective one of the caps of the end contacts of the fuse cartridge, there may be provided that at least one contact sheet which is adjacent the cap of the end contact of the fuse cartridge is fastened to the cradle, said contact sheet being provided with a portion that projects beyond the cradle and that is caused to abut a connecting contact of the signal circuit when the slide switch is in the switch-on position.

As compared to the also conceivable possibility which consists in designing one connecting contact of the signal circuit as a sliding contact, such a contact sheet has the advantage that its portion, which is provided to establish an electrical connection with the connecting contact, does not rub against other component parts of the safety fuse switch, neither during insertion or removal of the fuse cartridge, nor during displacement of the cradle. The abrasion which is caused by this wiping motion of both the sliding contact and the component parts of the switch along which the sliding contact is sliding with friction is avoided as a result thereof.

In another configuration of this embodiment there may be provided that the connecting contact of the signal circuit that is caused to abut the contact sheet is formed by the connecting wire of a component part of the signal circuit.

Accordingly, the expenditure in component parts of the signal circuit can be kept low by saving a separate component part forming the connecting contact.

Another problem with safety fuse switches of the type mentioned herein above is that in the hereto before known structural shapes, the slide switches may be displaced or pivoted continuously, i.e. without any resistance, between the switch-on position and the switch-off or replace position. As a result thereof, it is possible to slowly strip off or remove the caps of the end contacts of the fuse cartridge from the case contacts by slowly displacing or pivoting the slide switch. The electrical circuit which is protected by the fuse cartridge can thus be opened slowly, wherein said slow opening may cause high transition resistances to occur between the case contacts and the caps of the end contacts or even arcs to be drawn between said components. Both phenomena result in a strong local rise in temperature that may cause the safety fuse switch to be damaged and/or destroyed.

According to a preferred embodiment of the invention, measures have been taken by means of which the just discussed problem of the possible slow stripping of the caps of the end contacts of the fuse cartridge from the case contacts may be reliably avoided. These measures

comprise a snap connection that positively fixates the slide switch in its switch-on position in the case.

On displacing or pivoting the slide switch from its switch-on position into its switch-off or replace position, this snap connection opposes said displacement or pivotal motion a retaining force. In order to be indeed capable of executing said displacement or pivotal motion, a relatively high force must be exerted onto the slide switch at the very beginning of the motion. Once the retaining force of the snap connection is overstepped, an average person is not capable of suddenly reducing the built up force, said built up force rather causing the displacement or pivotal motion of the slide switch to suddenly start and to subsequently be carried out in a fast way altogether. As a result thereof it is also made certain that the caps of the end contacts of the fuse cartridge are abruptly disconnected from the case contacts so that the problems experienced in the state of the art proposals are efficiently avoided.

On account of the fast disconnection of the fuse cartridge from the case contacts, which is compulsory, a safety fuse switch configured in accordance with the invention permits to interrupt even high currents without the risk of damaging the safety switch being involved; the safety fuse switch according to the invention may be utilized as a load switch as a result thereof.

According to a particularly preferred embodiment of the invention, there may be provided that the snap connection comprises at least one snap lug that is fastened to the slide switch or in the case and at least one bight portion that is arranged in the case or on the slide switch respectively, the snap lug snapping into said bight portion when the slide switch is in the switch-on position.

Such a snap connection can be manufactured with particular ease and also is particularly reliable on account of its simple structure.

In another embodiment of the invention there may be provided that the snap lug is arranged on the first free end of a leaf spring, said leaf spring being attached by its other end to the slide switch or in the case respectively.

A thus constructed snap connection is provided with a retaining force that is sufficiently high for the purposes of the present invention without becoming too high, which could be the case when a snap lug made from an inflexible material were rigidly fastened.

The invention will be described more explicitly herein after with the help of particularly preferred embodiments illustrated in the drawings.

Fig. 1a is an oblique elevation of a safety fuse switch according to the invention, the slide switch 22 being in its switch-on position;

Fig. 1b is an oblique elevation of a safety fuse switch according to the invention, the slide switch 22 being in its switch-off or replace position;

Fig. 2 is an oblique elevation of the safety fuse switch of Fig. 1, one half of the case 3 having been taken off, its slide switch 22 being in the switch-off or replace position;

Fig. 3 is an oblique elevation of the safety fuse switch of Fig. 1, one half of the case 3 and the lighting cover having been taken off, its slide switch 22 being in the switch-on position;

Fig. 4a, b are oblique elevations of the case contacts 14 and of the rails 93 that are fastened thereto;

Fig. 5 is an oblique elevation of a U-shaped spring 17 that urges the free ends 16 of the case contacts 14 against the caps 21 of the end contacts;

Fig. 6 is an oblique elevation of the slide switch 22 of the safety fuse switch according to the Figures 1 through 3;

Fig. 7a-c are oblique elevations of various designs of a cradle 24 that may be mounted in the slide switch 22 according to Figure 6, each Figure illustrating said cradle without fuse cartridge 20;

Fig. 8 is an oblique elevation of half 2 of the case of the safety fuse switch according to the Figures 2, 3 only;

Fig. 9 is an oblique elevation of half 3 of the case of the safety fuse switch according to the Figures 2, 3 only;

Fig. 10a, b is a side elevation of another embodiment of a safety fuse switch, half 3 of the case having been partially omitted, the slide switch 22 being in the switch-on position in Fig. 10a and in the switch-off or replace position in Fig. 10b;

Fig. 11 is a side elevation of still another embodiment of a safety fuse switch, half 3 of the case having been partially omitted, the slide switch 22 being in the switch-off or replace position;

Fig. 7a-c are oblique elevations of various designs of a cradle 24 that may be mounted in the slide switch 22 according to Figure 6, each Figure illustrating said cradle without fuse cartridge 20;

Fig. 8 is an oblique elevation of half 2 of the case of the safety fuse switch according to the Figures 2, 3 only;

Fig. 9 is an oblique elevation of half 3 of the case of the safety fuse switch according to the Figures 2, 3 only;

Fig. 10a, b is a side elevation of another embodiment of a safety fuse switch, half 3 of the case having been partially omitted, the slide switch 22 being in the switch-on position in Fig. 10a and in the switch-off or replace position in Fig. 10b;

Fig. 11 is a side elevation of still another embodiment of a safety fuse switch, half 3 of the case having been partially omitted, the slide switch 22 being in the switch-off or replace position;

Fig. 12 is the same view of the safety fuse switch according to Fig. 11, the slide switch 22 being in the switch-on position;

Fig. 13 is an oblique elevation of an electric signal circuit 53 for indicating the failure of the fuse cartridge 20 presently contained in the safety fuse switch;

Fig. 14 is an oblique elevation of the contact sheet 40 that abuts on the first connecting contact 54 and is fastened to the cradle 24 and

Fig. 15 is the flow diagram of the signal circuit 53 according to Fig. 13.

The safety fuse switch according to the invention that is illustrated in Fig. 1a, b is provided with a case 1 that is composed of two case halves 2, 3 that are joined together by means of conventional connecting means such as screws or rivets.

In the front vertical end wall, case 1 is provided with a first opening 6 through which the first connecting wire of the electrical conductor to be monitored may be threaded into the case 1.

In the rear vertical end wall 7 (see Fig. 1b, 2, 3) there is provided a corresponding opening 8 for the second connecting wire of the electrical conductor to be monitored.

Furthermore, the front and rear end walls 5, 7 are provided with second openings 6', 8' through which the connecting wires of the neutral conductor are threaded.

As can be surveyed from the Figs. 2 and 3, a terminal screw 9 is located behind the respective one of the openings 6, 6', 8, 8' and receives the bare ends of the connecting wires. These terminal screws 9 may be designed in any known way, the terminal screws 9 of the accompanying drawings were configured as so-called lift terminals by way of example only.

This type of terminal screw comprises a frame 90 that is carried in a recess 94 of the case so

as to be slidable in vertical direction with regard to the Figs. 2, 3, a thread being cut into the upper transverse part 91 thereof. A pan head screw 92 is screwed into this thread. A rail 93 made from a material with good conducting properties, preferably from copper, extends across frame 90, said rail 93 connecting the conductor which is connected to the terminal screw 9 to the other electrical components of the safety fuse switch. The tip of pan head screw 92 rests on the rail 93 (compare Figs. 11, 12) so that the frame 90 is lifted when pan head screw 92 is rotated in the screwing direction, i.e., the lower transverse part 95 of the frame is moved toward rail 93. The bare end of the conductor to be connected is introduced between the rail 93 and the lower transversal part 95 of frame 90 and is wedged between these two component parts when the pan head screw 92 is tightened.

On the exterior side of the bottom wall 10 of case 1, which is shown lying in the bottom part of the Figs. 2, 3, there is provided a dovetailed groove 11, whose front side is limited by a quick-fixing bolt 12, the actuating bar 13 thereof emerging toward the front through the front end wall 5 of case 1. The quick-fixing bolt 12 is movably guided in horizontal direction with regard to Figs. 2, 3 in a hollow space of bottom wall 10. With this configuration, the safety fuse switch in accordance with the invention can be mounted to commercial subbases with hat profiles.

The connecting wires of the conductor to be monitored with regard to overload current are connected to the terminals 9 that are situated on the top in the Figs. 2, 3. The rails 93 that are located in these terminals 9 are connected to stationary case contacts 14 that are designed as tulip contacts (also compare Fig. 4a, b) and are made from a material with good conducting properties, preferably from copper. The lower connecting webs 15 of these case contacts 14 are wedged into channel-like configurations 19 of the first case half 2, the case contacts 14 being fixated on the case in the positions illustrated as a result thereof.

To make this direct fixation of electrically conductive component parts to the case halves 2, 3 possible, the case 1 is made out of an insulating material such as plastic material for example. The free ends 16 of the case contacts 14 receive between them a respective one of the caps of the end contacts 21 of fuse cartridge 20. In order for the free ends 16 to be pressed with sufficient pressure against the caps 21 of the end contacts, U-shaped springs 17 are provided (also compare Fig. 5) that form a grip around the case contacts 14 and press their free ends 16 against the caps 21 of the end contacts. In order for the springs 17 not to become displaced relative to the case contacts 14, said case contacts are provided with impressions 18 that receive between them the arms of the springs 17.

There is provided a slide switch 22 that receives the fuse cartridge 20. In the exemplary embodiment of the Figs. 2 and 3 said slide switch 22 is configured as a drawer and is slidably guided in case 1 between a switch-on position (Fig. 3) and a switch-off or replace position (Fig. 2). This guidance is achieved by means of the guide beads 23, 23' that are formed on the case halves 2, 3 and on which the slide switch 22 abuts with its side faces 220, 221. Like case 1, the slide switch 22 is also made of an insulating material.

According to the invention, fuse cartridge 20 is not directly received by the slide switch 22, a cradle 24 is rather provided for this purpose. Said cradle 24 is provided with a device for receiving a fuse cartridge 20, said receiving device being formed by a bore 240 made in the cradle 24 in the exemplary embodiments illustrated in the Figs. 2 through 9 (also compare Figs. 7a-c).

As shown in Fig. 2, the bore 240 is only arranged in the central part of the fuse cartridge 20 that is made of ceramics, whereas the two caps 21 of the end contacts of the fuse cartridge 20 are lying bare. The cap 21 of the end contacts on the right side of Fig. 2 is altogether situated outside the cradle 24, the cap 21 of the end contacts on the left side of Fig. 2 is arranged in an aperture 241 of the cradle 24.

The cradle 24 is slidably carried in the slide switch 22, said carrying arrangement being realized in the exemplary embodiment of the Figs. 2 through 9 by a groove 222 embedded in the slide switch 22, a bead 242, which is formed on the cradle, engaging said groove. Accordingly, cradle 24 is carried in such a manner that it may be slid parallel to the slide switch 22 in the direction indicated in Fig. 2 by the double-headed arrow 25, said slide switch being in turn carried in case 1 so as to be slidable in direction of the double-headed arrow 26.

The slide switch 22 is translated from its switch-on position (Fig. 3) into the switch-off or replace position (Fig. 2) in which the fuse cartridge 20 is taken out of or inserted into the conductor to be protected by hand. As shown in Fig. 3, in the switch-on position, the caps 21 of the end contacts of the fuse cartridge 20 are located on the level of the case contacts 14 which form a grip around the caps 21 of the end contacts in the manner of tongs and abut thereon. This tong-like grip around the caps 21 of the end contacts is possible because they are, as already explained, freely accessible.

If the cradle 24 would remain on the level of the case contacts 14 when the slide switch 22 is drawn into the switch-off or replace position (Fig. 2), the fuse cartridge 20 would lie within the slide switch 22; it would then not be accessible and could only be taken out with difficulty.

The solution to this problem according to the invention is that, during the discussed displacements of the slide switch 22, the cradle 24 is automatically traveled in the direction of the double-headed arrow 25. This displacement of the cradle causes the fuse cartridge 20 to be shifted so far relative to the slide switch 22 on passing from the switch-on position (Fig. 3) to the switch-off or replace position (Fig. 2) that a portion of the fuse cartridge 20 projects beyond the slide switch 22. In order for the fuse cartridge 20 to be capable of being translated beyond the side face 221 of the slide switch 22, said fuse cartridge is provided with a corresponding recess 223. Fuse cartridge 20 may now be grasped by hand at this now freely accessible portion of the fuse cartridge 20 and may be drawn out of the bore 240 or another fuse cartridge 20 can be inserted into bore 240.

When the slide switch 22 is translated back into the switch-on position (Fig. 3) after insertion of a new fuse cartridge has been completed, the cradle 24 is traveled into the other direction so that the caps 21 of the end contacts of the fuse cartridge 20 are brought back on the level of the case contacts 14.

According to the invention, the discussed displacement of the cradle 24, which is coupled to the displacement of the slide switch 22, is carried out as follows:

A pin 27 is formed on cradle 24, said pin engaging into a coulisse 28 arranged on the insulating case 1. In the exemplary embodiment of the Figs. 2 through 9, said coulisse 28 is worked into the broadside wall 29 of case half 2 (compare Fig. 8) and is a groove which is slightly wider than the diameter of pin 27 so that the latter is capable of gliding with little clearance in the coulisse 28. In order for the pin 27 to be capable of extending across the partition wall 224 of slide switch 22, said partition wall is provided with a corresponding aperture 225. Said partition wall 224 is provided with groove 222 which is needed to guide the cradle 24.

The coulisse 28 must be formed in such a manner that, on displacement of the slide switch 22, it translates the pin 27 in direction of the double-headed arrow 25, thus causing cradle 24 to be shifted in direction of the double-headed arrow 25.

According to the particularly preferred exemplary embodiment of Fig. 8, the first portion 280 of coulisse 28 is oriented in the displacement direction of slide switch 22 (double-headed arrow 26) so that, as long as the pin 27 is in this first portion 280, cradle 24 is not displaced relative to slide switch 22. The second portion 281 of coulisse 28, which adjoins the first portion 280, departs from the displacement direction of slide switch 22 (double-headed arrow 26).

As a result of this configuration of coulisse 28, the fuse cartridge 20, as long as it is situated in the region of the case contacts 14, is only shifted in parallel orientation when the slide switch 22 is translated, so that the caps 21 of its end contacts are taken out of the case contacts 14 normal thereto. Any lateral motion of the fuse cartridge 20, which would cause the caps 21 of the end contacts to unnecessarily rub against the case contacts 14, is thus avoided.

As shown in Fig. 8, said second portion 281 has a rectilinear orientation as well but is positioned at an angle from 30.degree. to 45.degree. to the displacement direction of the slide switch 22, which is symbolized by the double-headed arrow 26. Of course, these 45.degree. only represent a possible exemplary embodiment, the departure of the second portion 281 of the coulisse from the displacement direction of the slide switch may in principle be chosen to achieve any extent although the following two limitations have to be taken into consideration: If the angle 30 is chosen to be relatively small (the second portion 281 of the coulisse only departing slightly from the displacement direction of the slide switch), the cradle 24 is caused to only shift slightly, which is possibly too little to achieve the goal aimed at by the displacement of the cradle viz., to provide free access to a portion of the fuse cartridge 20.

With relatively large angles 30 however, a high sliding friction occurs between pin 27 and coulisse 28, the displacement of the slide switch 22 being impaired or at least becoming problematic as a result thereof.

In view of these two conditions, angles 30 ranging from 30 to 60.degree. proved ideal to achieve the object of the present invention. The transition between the first portion 280 and the second portion 281 is configured as an arc of a circle in order for pin 27 to be capable of gliding without any problem alongside the entire coulisse 28.

However, the reader has to be apprised of the fact that the rectilinear orientation of the two portions 280, 281 illustrated in Fig. 8 are not compulsory, the displacement of the cradle 24 in accordance with the invention being also achieved when the second portion 281 is curved like an arc of a circle, a segment of a parabola, or the like. Therefore, coulisses 28 designed in this way are to be considered to lie within the scope of the invention.

The diameter of the bore 240 arranged in cradle 24 is adapted to the diameter of the fuse cartridge 20 to be received, which in turn depends on the rated current of fuse cartridge 20.

The rated fusing current of the safety fuse switch may therefore be changed with particular ease by using fuse cartridges 20 having various rated currents. To thus change the rated current, the safety fuse switch only needs to be slightly modified in that different cradles 24 having bores 240 of various sizes are to be provided (compare Figs. 7a-c).

For the manufacturing of safety fuse switches with various rated currents, this signifies that manufacture of the majority of the components, i.e. case 1, slide switch 22 and all of the electrically conductive components (terminals 9, rail 93, case contacts 14, and so on) may be standardized and that only the cradles 24 are to be adapted to the different diameters of the various fuse cartridges 20.

In the exemplary embodiment of Figs. 2 through 9, when the slide switch 22 is shifted from its switch-on to its switch-off position, it is not only the fuse cartridge 20 that is taken out of the case contacts 14, thus causing the very conductor to be monitored to be interrupted, a second conductor, which is connected to the terminals 9 situated at the bottom in the Figs. 2, 3, is also interrupted at the same time. As a rule, such a co-connected conductor is the neutral conductor which, together with the conductor to be monitored, forms a single phase electric circuit for the consumers connected in rear of the safety fuse switch. The co-connection of the neutral conductor causes the advantageous disconnection of all of the terminals of the consumers connected in rear thereof.

Conductor rails 96 are provided whose first ends extend into the lower terminals 9. The second ends of these conductor rails 96 are located underneath the two case contacts 14.

In the region of the slide switch 22 that is situated at the bottom in the Figs. 2, 3, there is worked a U-shaped groove 226 in which is wedged an also U-shaped contact bridge 31. The two ends 32 of this contact bridge 31 are located outside said groove 226 and abut on the second ends of the conductor rails 96 when the slide switch 22 is in the switch-on position. In order for this abutment to occur with a pressure that is high enough to make good electrical contact, a helical pressure spring 33 is arranged between the ends 32 of the contact bridge 31, said spring urging the ends 32 of the contact bridge against the second ends of the conductor rails 96.

As can be surveyed from Fig. 3, there is arranged underneath the upper cover plate 228 of slide switch 22 an electrical signal circuit 53 that permits to display the failure of the fuse cartridge 20 which is presently contained in the safety fuse switch and which is to be replaced as a result thereof.

This signal circuit 53, which is separately illustrated in Fig. 13, is provided with two connecting contacts 54, 55. When slide switch 22 is in its switch-on condition, each connecting contact 54, 55 is connected with a respective one of the caps 21 of the end contacts of the fuse cartridge 20.

This signal circuit 53, which is very simple in construction, is a serial connection consisting of a resistor 36 and of a glow lamp 37, both components being arranged on a printed board 38.

Resistor 36 is thereby oriented with its longitudinal axis normal to the printed board 38 and one of its connecting wires is curved in such a manner that it is oriented parallel to the resistor 36.

A contact sheet 40 is fastened to the cradle 24, said contact sheet abutting on the cap 21 of an end contact of a completely inserted fuse cartridge 20, said end contact being situated on the left side in Figs. 2, 3. Said contact sheet 40, which is illustrated separately in Fig. 14, is provided with a portion 41 that extends beyond cradle 24, said portion 41 extending across a slot-like recess 244 of the cradle 24. In the switch-on position of slide switch 22, said portion 41 abuts on the first connecting contact 54 of signal circuit 53 (compare Fig. 3). Contact sheet 40 is fastened to cradle 24 by means of a groove 245 arranged in cradle 24, contact sheet 40 being wedged into said groove.

The first connecting contact 54 is preferably formed by the connecting wires of a component part of signal circuit 53, the first connecting contact 54 being formed by the connecting wire of resistor 36 that is oriented parallel to said resistor 36 in accordance with the exemplary embodiment shown in the drawing.

The second connecting contact 55 of the signal circuit is formed by a helical spring 39, the first end of which is connected to the glow lamp 37 and the second end of which freely protrudes from the printed board 38 in direction of cradle 24.

If slide switch 22 is in its switch-on position (Fig. 3), portion 41 of contact sheet 40 abuts on the connecting wire of the resistor and the freely protruding end of helical spring 39 abuts on the other cap 21 of the end contact of fuse cartridge 20.

The way of operation of signal circuit 53 can best be explained with the help of its flow diagram, which is shown in Fig. 15. If the fuse cartridge 20 is intact, the caps 21 of its end contacts are shorted and the two connecting contacts 54, 55 of the signal circuit are at the same voltage level so that there is no current flow therein and the glow lamp 37 can not illuminate.

If the fuse wire of the fuse cartridge 20 melts, the signal circuit 53 is in series with the consumer (represented by R_{LOAD}) connected in rear thereof. As the resistance of the glow lamp 37 is very high, i.e. more than 1000 times an average load resistance R_{LOAD} , a very small current only flows through the series connection out of signal circuit 53 and consumer. This small current is sufficient to cause glow lamp 37 to illuminate and to thus display the failure of fuse cartridge 20.

In order for the illumination of glow lamp 37 to be recognizable from the outside, the upper cover plate 228 is provided in the region of glow lamp 37 with an aperture 229 that may possibly be closed by means of a transparent material such as plastic or glass.

Hitherto it has always been assumed that the displacement direction of slide switch 22 is rectilinear. This merely represents a preferred exemplary embodiment though, the slide switch 22 could as well be shifted along a path describing an arc of a circle. This can be achieved simply in configuring the side walls 220, 221 of slide switch 22 so as to have the shape of concentric arcs of a circle and in concurrently giving the guide beads 23, 23' the shape of an arc of a circle, these segments of arcs having a common center.

Cradle 24 is provided here with a bottom plate (which is invisibly arranged under the fuse cartridge and rests on the slide switch 22 in Fig. 10), side walls 243 being formed on said bottom plate. These side walls 243 emerge from the plane of the image of Fig. 10a, b and have the fuse cartridge 20 wedged between them. Guide beads 227, which emerge from the plane of the image of Fig. 10a, b as well, are fastened to slide switch 22. The side walls 243 can glide along these guide beads 227, cradle 24 being slidably carried in the longitudinal direction of the fuse cartridge 20 as a result thereof.

A plate 246, which extends parallel to the bottom plate of the cradle and extends beyond the guide bead 227, is formed on one of the side walls 243 and carries the pin 27.

In this exemplary embodiment, the displacement direction of slide switch 22 does not have a linear orientation but describes an arc of a circle as it is indicated by the double-headed arrow 26'. In order to achieve the displacement of the cradle provided in accordance with the invention and occurring in function of the pivotal motion of the slide switch 22, at least one portion 281 of coulisse 28 must again depart from the direction of pivotal motion of slide switch 22.

Analogous to the exemplary embodiment in the Figs. 2 through 9, the first portion 280 of coulisse 28 according to Fig. 10a, b is oriented in the direction of displacement and has the same shape of an arc of a circle as said displacement direction. The second portion 281 departs from said displacement direction of slide switch 22 inasmuch as it has a straight orientation and is arranged in such a manner that it draws a tangent to the arc of a circle described by the first portion 280.

This configuration of coulisse 28 causes the cradle 24 to be displaced relative to slide switch 22, said slide switch being in the switch-off or replace position (Fig. 10b), to such an extent that a portion of fuse cartridge 20 extends beyond slide switch 22. On traveling slide switch

22 into its switch-on position (Fig. 10a), fuse cartridge 20 is displaced in its longitudinal direction and, in the switch-on position of slide switch 22, as illustrated in Fig. 10a, the caps 21 of its end contacts can be encompassed by the stationary case contacts 14 that are again configured like tulips.

Instead of the hereto before discussed translational displacement of slide switch 22, it is also possible to rotatably, i.e. pivotally carry said switch in case 1. This case, which is also comprised in the present invention, is illustrated in the Figs. 11 and 12, Fig. 11 showing the switch-off or replace position in a way similar to Fig. 2 and Fig. 12 showing the switch-on position of slide switch 22 in a way similar to Fig. 3.

It has to be noted beforehand that the safety fuse switch shown here is unipolar, which is also the case with the one of Fig. 10, i.e., in contrast to the embodiment according to the Figs. 2 through 9, said switch does not connect or disconnect the neutral conductor together with the conductor to be monitored. Accordingly, this co-connection of the neutral conductor is not compulsory but merely an optional feature of the present invention.

Here, the slide switch 22 is configured as a disk. Analogous to Fig. 10a, b, the guide beads 23, 23' have the shape of an arc of a circle and are formed concentric with the disk-shaped slide switch 22 on the case halves 2, 3.

Like in Fig. 10a, b, the cradle 24 is provided with a bottom plate (which is in the Figs. 11, 12 invisibly arranged under the fuse cartridge 20 and rests on slide switch 22), side walls 243 being formed on said bottom plate. These side walls 243 emerge from the plane of the image of the Figs. 11, 12 and have the fuse cartridge 20 wedged between them. Guide beads 227, which emerge from the plane of the image of the Figs. 11, 12 as well, are fastened to slide switch 22. The side walls 243 can glide along these guide beads 227, cradle 24 being slidably carried in the longitudinal direction of the fuse cartridge 20 as a result thereof.

The pin 27, which emerges from the aperture 225 and engages the coulisse 28 arranged on the broadside wall 29 of case half 2, is formed on the underside of the bottom plate of the cradle that rests on the slide switch 22. In this exemplary embodiment, the displacement direction of slide switch 22 does not describe a straight line but an arc of a circle, as it is indicated by the double-headed arrow 26".

In order to achieve the displacement of the cradle as provided by the invention in function of the pivotal motion of slide switch 22, at least one portion of coulisse 28 must again depart from the direction of the pivotal motion of slide switch 22. In the Figs. 11, 12, coulisse 28 is altogether configured as an arc of a circle, the center of the circle of coulisse 28 being displaced relative to the center of slide switch 22. As clearly shown in the Figs. 11, 12, the

inventive idea of displacing cradle 24 relative to slide switch 22 when said slide switch is pivoted to such an extent that a portion of fuse cartridge 20 extends beyond slide switch 22, may again be realized. In order for the slide switch 22 to be pivotal by hand, a lever 35, which always extends beyond case 1, is formed on slide switch 22.

The embodiments according to the Figs. 10 a, b and 11, 12 respectively, may also be provided with a signal circuit 53 for displaying the failure of the inserted fuse cartridge 20. In the accompanying drawings, it is only explicitly illustrated in Fig. 10a, b. Unlike signal circuit according to Figs. 2, 3 or Fig. 13 respectively, the two connecting contacts 54, 55 are here formed by separate component parts, viz., pegs that emerge from the plane of the image of Fig. 10a, b. Moreover, a printed board 38 has been dispensed with and the components of the signal circuit 53, which again consists of a series connection of glow lamp 37 and resistor 36, have been directly fastened to the slide switch 22.

It also differs from Figs. 2, 3 in that here, two contact sheets 40 are fastened to cradle 24, said contact sheets being each connected to a respective one of a cap 21 of the end contacts of a completely inserted fuse cartridge 20. These two contact sheets 40 may of course also be provided in the exemplary embodiment of Figs. 2, 3 and in reverse, it is also possible to configure one of the two connecting contacts 54, 55 in the fuse switch of Fig. 10a, b as a sliding contact such as a helical spring 39.

Another measure in accordance with the invention to be carried out on a safety fuse switch consists in providing a snap connection which, in principle, may have any configuration, said snap connection positively fastening the slide switch 22 in its switch-on position in case 1.

As can be seen more specifically in the Figs. 2 and 3 or 6 and 8 respectively, the snap connection is comprised of two snap lugs 50 that are fastened to the side walls 220, 221 of slide switch 22 on one side and of bight portions 51 embedded in the guide beads 23, 23' on the other. The respective snap lugs 50 and bight portions 51 are positioned in such a manner that the snap lugs 50 snap into the bight portions 51 when slide switch 22 is in its switch-on position.

The snap lugs 50 are thereby not rigidly fastened to the side walls 220, 221 of the slide switch, there is rather provided a leaf spring 52 whose second end is fastened to slide switch 22 and whose first, free end carries snap lug 50. Snap lug 50, leaf spring 52 and slide switch 22 are preferably configured as one unit, which, in practical realization, consists in forming leaf spring 52 and snap lug 50 as sprues on slide switch 22.

The arrangement of snap lug 50 on a leaf spring 52 presents the advantage that, on shifting slide switch 22, in which case snap lug 50 abuts on the guide beads 23, 23', the snap lug 50 may be slightly pivoted away from said guide beads 23, 23', i.e., it may be moved away therefrom, which entails that the snap lugs 50 do not exceedingly rub against the guide beads 23, 23'. The movements of the slide switch are thus prevented from being restrained. It is however certainly possible to rigidly fasten the snap lugs 50 on slide switch 22.

It is the object of this snap connection to oppose a retaining force to the displacement of slide switch 22 from its switch-on into its switch-off or replace position. If such a displacement is carried out, a relatively high force, that is to say a force that overcomes the retaining force of the snap connection, must be exerted onto slide switch 22 at the very beginning of said displacement.

This high force causes the displacement of the slide switch to occur suddenly, the fuse cartridge 20 being suddenly separated from the case contacts 14 as a result thereof. This entails the abrupt interruption of the electrical circuit to be protected, said abrupt interruption reliably and efficiently preventing high transition resistances from occasionally building up between fuse cartridge 20 and case contacts 14, or arcing between said two components respectively.

The just discussed object of the snap connection is achieved just as well when the snap lugs 50 are formed on the guide beads 23, 23' and when the bight portions 51 are embedded in the side walls 220, 221 of slide switch 22, so that this embodiment too lies within the scope of the invention. The number of the respective snap lugs 50 and bight portions 51 is discretionary, the lower limit thereof being of course one snap lug 50 and one mating bight portion 51.

The snap connection according to the invention may also be provided on safety fuse switches whose slide switches 22 have shapes illustrated in the respective Figs. 10a, b and 11, 12. As explicitly illustrated in the Figs. 11, 12 and unlike provided in the Figs. 2, 3, the leaf spring 52 is to be fastened in case 1 by snap lug 50 and bight portion 51 is to be formed on slide switch 22.

Emphasis is to be particularly laid on the fact that the just discussed snap connection according to the invention is completely independent of the presence of a slidable cradle 24. Accordingly, said snap connection may also be provided on such safety fuse switches that are not provided with any cradle 24 and in which fuse cartridge 20 is directly held on slide switch 22.

CLAIMS

1. A safety fuse switch with
an insulating case (1) in which two hot case contacts (14) are arranged so as to be stationary and
with a slide switch (22) that is also made of insulating material and is slidably or pivotally guided in the insulating case (1) between a switch-on position (Fig. 3 and Fig. 12 resp.) and a switch-off or replace position (Fig. 2 and Fig. 11, resp.), a fuse cartridge (20) being received therein,
the caps (21) of the end contacts of said fuse cartridge being directly adjacent the stationary case contacts (14) when they are in the switch-on position (Fig. 3 and Fig. 12 resp.) and
being held apart from the stationary case contacts (14) when they are in the switch-off or in the replace position (Fig. 2 and Fig. 11, resp.),
characterized by a cradle (24) that is slidably carried in the slide switch (22) and holds the fuse cartridge (20), said cradle having a pin (27) that engages into a coulisse (28) arranged on the insulating case (1), said coulisse (28) being shaped in such a manner that, when the slide switch (22) is displaced or pivoted, the cradle (24) is displaced relative to said slide switch so that a portion of the fuse cartridge (20) extends beyond the slide switch (22).
2. The safety fuse switch of claim 1, **characterized in that at least one portion (281) of the coulisse (28) departs from the direction of displacement or pivotal movement of the slide switch (22).**
3. The safety fuse switch of claim 2, **characterized in that the coulisse (28) has two portions (280, 281), the first portion (280) being oriented toward the displacement or pivotal direction of the slide switch (22) and the second portion (281) departing from the displacement or pivotal direction of the slide switch (22).**
4. The safety fuse switch of claim 3, **characterized in that the two portions (280, 281) of the coulisse (28) are rectilinear and that the second portion (281) is positioned at an angle (30) ranging from 30 to 60.degree., preferably at an angle of 45.degree., to the direction of displacement of the slide switch.**
5. The safety fuse switch of one of the claims 1 through 4 comprising a signal circuit (53) which is arranged on the slide switch (22) and comprises two connecting contacts (54, 55) and

which is designed to indicate failure of the inserted fuse cartridge (20), each connecting contact (54, 55) being connected to a respective one of the caps (21) of the end contacts of the fuse cartridge (20), **characterized in that** at least one contact sheet (40), which is adjacent the cap (21) of the end contact of the fuse cartridge (20), is fastened to the cradle (24), said contact sheet being provided with a portion (41) that projects beyond the cradle (24) and that is caused to abut a connecting contact (54, 55) of the signal circuit (53) when the slide switch (22) is in the switch-on position.

6. The safety fuse switch of claim 5, **characterized in that** the connecting contact (54) of the signal circuit (53) that is caused to abut on the contact sheet (40) is formed by the connecting wire of a component part of the signal circuit (53).

7. The safety fuse switch of one of the claims 1 through 6, **characterized by a snap connection** that positively fixates the slide switch (22) in its switch-on position in the case.

8. The safety fuse switch of claim 7, **characterized in that** the snap connection comprises at least one snap lug (50) that is fastened to the slide switch (22) or in the case (1) respectively and at least one bight portion (51) that is arranged in the case (1) or on the slide switch (22) respectively, the snap lug (50) snapping into said bight portion (51) when the slide switch (22) is in the switch-on position.

9. The safety fuse switch of claim 8, **characterized in that** the snap lug (50) is arranged on the first free end of a leaf spring (52), said leaf spring (52) being attached by its other end to the slide switch (22) or in the case (1) respectively.