Switch

The present invention relates to a switch according to the preamble of Claim 1.
A switch mechanism for a protective switch, having a contact pair comprising a fixed contact and a movable contact arm, a switch toggle, and a contact position indicator, is known from EP 0 897 186 A. In order to achieve sudden closing of the contacts, a spring switch lever is provided for locking the contact arm in the open position, the lock being able to be unlocked by rotating the switch toggle. The device of EP 0 897 186 A has the disadvantage that particularly when switching higher currents and higher voltages, the danger of welding of the contacts exist, particularly when switching a high inductive load, as of motors, for example.
DE 40 14 191 A1 discloses a switch having a manually operated switch toggle, which has a kidney-shaped guide recess on its inner housing side, in which a compression plunger connected to the contact bridge is guided. When the switch toggle is actuated, the compression plunger is carried along by the guided recess, until its dead center is reached. If the dead center is exceeded, the pressure plunger moves rapidly upward and the contact bridge closes the connection.
US 5,300,906 A discloses a switching device for use in safety mechanisms. The switch has a guided, movable switching bridge and a retaining and triggering mechanism which functions using magnets. A retaining arm is mounted by a magnet and ensures that the switch remains closed. It acts against a spring which attempts to open the contacts. When the switch is triggered manually, the retaining arm is disconnected from the magnets by a manually caused rotational movement of the control device and the contacts are opened by the spring. After opening, the arm which carries the magnets swings downward and captures the retaining arm.
Finally, such a switch, in which the handle is connected via a toggle system to the contact bridge, the joint of this toggle system being guided in a crank and a spring engaging on this joint, is known from EP 1 054 421 A. The disadvantage results in this case, however, that the crank, which requires an essentially triangular path of the joint, has a relatively complex shape in order to achieve a closing speed of the contact bridge essentially independent of the speed of the actuation of the handle. However, only a relatively low

closing speed of the contact bridge having a relatively slow buildup of the contact pressure during closing of the contacts may be achieved in this case.

At higher currents and/or higher inductive load, typical switching devices tend to weld the contacts and thus to destroy the switching device because of the slow buildup of the contact pressure.

The object of the present invention is to overcome this disadvantage and suggest a switch of the type cited at the beginning, which is also suitable for switching higher currents, in which the danger of welding the contacts, particularly when switching a high inductive load, as of motors, for example, is largely avoided, and which is distinguished by a simple construction.

This is achieved according to the present invention in a switching device of the type cited at the beginning by the characterizing features of Claim 1.

Through the measures suggested, upon an actuation of the handle in the direction of the closed position of the switch, the support part is moved in the direction of the closed position, the contact bridge being carried along. Upon reaching a specific position, a further movement of the contact bridge is suppressed by the catch, the contact springs being tensioned upon a further movement of the handle. If the catch is then triggered, the contact bridge is moved rapidly against the fixed contacts by the tensioned contact springs, the contact pressure building up very rapidly.

An achievement of the object having a very simple construction results through the measures suggested in Claim 2. In this case, the contact slide may be produced from an electrically insulating material.

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In this case, it is advantageous to provide the features of Claim 3. This allows a rotational movement of the handle to be converted into a translational movement in a simple way, the support part being guided in the contact slide.
A very secure formfitting catch of the movement of the contact slide results through the features of Claim 4. The use of an angle lever allows a very compact construction of the catch in this case, which may be triggered easily by the crank of the handle.
The features of Claim 5 ensure that the contact slide is controlled by the handle, mutual displacement of the support part in relation to the contact slide being possible in certain limits.
The features of Claim 7 are advantageous in regard to an expedient layout of the switch according to the present invention.

The present invention will be described in greater detail with reference to the attached drawing, in which embodiments are shown.

Figure 1 shows an exploded illustration of a switch according to the present invention,
Figure 2 schematically shows the switch according to Figure 1 in the open state,
Figure 3 schematically shows the switch in an intermediate position,
Figure 4 schematically shows the switch in a further intermediate position,
Figure 5 shows a detail of the contact slide having a support part of a contact spring, and
Figure 6 schematically shows the switch in the closed state.

The switch has a lower shell 1, in which a contact slide 10 is guided, in which a contact bridge 8 is mounted. The lower shell 1 works together with an upper shell 16 and forms a housing therewith, the two shells 1, 16 being connected to one another via fasteners 17, e.g., hollow rivets.
A handle 5 is mounted pivotably in this housing 1, 16, this handle 5 having a torsion spring 4 applied to it. Furthermore, a pointer 3 is mounted pivotably in the housing 1, 16, which is used to display the switching state of the switch.

Moreover, connection angles 13 having contacts, clamping screws 14, and clamps 15 for connecting wires are mounted in the housing 1, 16. Furthermore, a catch 7 for the contact slide 10 is provided, which is pre-tensioned against the catch position using a spring 6. A support part 11 for a contact spring 9 is mounted displaceably in the contact slide 10. The support part 11 is coupled to the handle 5 via a bow-shaped connecting rod 12. A catch slide 2 is provided for fixing the housing 1, 16, which allows attachment of the housing 1, 16 to a typical rail.

The support part 11 has lateral arms 30, which press against stops 31 of the contact slide 10 because of the pre-tension of the contact spring 9 (Figure 2), the support part 11 or its arms 30 being able to be raised from the stops 31 while increasing the pre-tension of the contact springs 9 (Figure 6). In addition, it is possible for the contact slide 10 to be carried along by the support part 11, which is coupled to the handle 5 via the bow-shaped connecting rod 12.

As may be seen from Figure 2, the contact spring 9 is only slightly pre-tensioned in the open position of the switch. However, because of the remaining pre-tension of the contact spring 9, it is ensured that the contact slide 10 is located in its final position, the lateral arms of the support part 11 pressing against the stops 31 of the contact slide 10. The contact bridge 8 is raised maximally off of the connection angles 13 including fixed contacts in this case. The catch 7 is located in the catch position, which is not active when the contacts are completely open, however, because of the pre-tension of the spring 6.

In the position of the switch shown in Figure 3, the handle 5 was pivoted around an angle of approximately 30° in the direction of the position of the handle 5 corresponding to the closed position of the contacts, which may be pivoted around an angle of approximately 90° in total. In this position of the handle 5 shown, the contact slide 10 was moved via the coupling via the bow-shaped connecting rod 12, the support part 11 of the contact spring 9, and this spring itself in the direction of the fixed contacts 32, which are mounted on the connection angles 13. A projection 33 protruding laterally from the contact slide 10 comes to rest on the catch 7, which is designed in the form of a pawl implemented as an angle lever. A further movement of the contact slide 10 in the direction of the fixed contacts 32 is thus suppressed. The contacts of the contact bridge 8 are mounted at a distance from the fixed contacts 32 of the connection angle.

Simultaneously, the pointer 3 is also pivoted and a color indicating the closed position of the switch begins to appear in a view window of the housing 1, 16.

As may be seen from Figure 4, in which the handle 5 is shown in a movement progressing further toward the closed position in relation to Figure 3, during the further movement of the handle, the support part 11 of the contact spring 9 is compressed further and its pre-tension is thus increased. The contact slide 10 remains in its position fixed by the catch 7, the support part 11, which is guided in a recess of the contact slide 10, being displaced relative thereto.

During this further movement of the handle 5, the arm 71 of the catch 7 is deflected by a crank 36 attached to the handle 5. The catch is thus pivoted and the hooked end of the second arm 72 releases the lateral projection 33 of the contact slide 10 (Figure 6). The contact springs 9 thus accelerate the contact slide 10 and therefore also the contact bridge 8 because of their pre-tension. A very rapid buildup of the contact pressure is thus ensured when the contact bridge hits the fixed contacts 32 of the connection angle 13 and the danger of welding contacts is avoided, even at high currents to be switched and significant inductive loads.

The contact slide 10 and in the support part 11, including contact spring 9, are shown in detail in Figure 5. The support part 11, on which the contact spring 9 are supported, is provided with a hole 34, in which one leg of the bow-shaped connecting rod 12 engages. The support part 11 is guided in a recess 35 of the contact slide 10 and between two final positions, one of which is determined by the lateral arms 30 (Figures 1, 5) of the support part 11 and the stops 31 of the contact slide 10, and the other of which is determined by the maximum compression of the contact spring 9.

As may be seen from Figure 6, the bow-shaped connecting rod 12 runs essentially parallel to the axis of the spring 9 and/or to the movement direction of the support part 11 in the closed position of the switch, a slight beyond-dead-center position also being able to be provided.

Upon a movement of the handle 5 in the direction of the position corresponding to the open position of the switch, as is shown in Figure 2, there is a reduction of the contact pressure and relaxation of the springs 9 at the same time, until the lateral arms 30 of the support part 11 come to rest on the stops 31 of the contact slide 10. In the further

sequence, the contact slide 10 is carried along by the support part 11 and raised off of the fixed contacts 33.

Because of the pre-tension of the contact springs 9, this procedure occurs very rapidly, since the springs 9 support the movement of the handle 5, while in contrast during the movement of the handle 5 in the direction of the position corresponding to the closed position of the switch, the force of the springs 9 must be overcome. However, a jump behavior is forced by the catch 7 when the switch is closed, which ensures a very rapid buildup of the contact pressure.

Patent Claims

1. A switch having a contact bridge (8) movable in relation to at least one fixed contact (32) between a first switch position and a second switch position, which is pre-tensioned toward its closed position using a contact spring (9), the contact bridge (8) being controllable by handle (5) via a coupling device (12, 11, 9), the contact bridge (8) being connected to a catch (7) controllable by the handle (5) and the contact spring (9) being supported on a support part (11), which is controlled by the handle (5) and is movable in relation to the contact bridge (8), the contacts of the contact bridge (8) being mounted in an intermediate position, between the completely open position and the closed position of the contacts, which ensures an electrically insulating distance to the fixed contacts (32), when the catch (7) is in the catch position, and a triggering device of the catch (7) being provided, characterized in that the contact bridge is guided transversely to its longitudinal extension.

2. The switch according to Claim 1, characterized in that the contact bridge (8) is mounted in a contact slide (10), and the catch device (7, 33) comprises a projection (33) protruding from the contact slide (10) and a pawl working together therewith.

3. The switch according to Claim 1 or 2, having a rotatably mounted handle (5), characterized in that the support part (11) of the contact spring (9) is guided in a recess of the contact slide (10) and is connected via a connecting rod (12) to the handle (5).

4. The switch according to one of Claims 1 through 3, characterized in that the pawl is implemented as an angle lever, which is mounted pivotably, one arm (71) working together with a crank (36) positioned on the handle (5), which is used as the triggering device, and the second arm (72) being implemented as hooked on its free end and engaging on the projection (33) of the contact slide (10) in a spring-loaded catch position.