

Description

Safety switch comprising a bimetallic snap disk

5 The invention relates to a circuit breaker having a bimetallic snap-action disk in accordance with the generic part of claim 1.

10 A circuit breaker known from DE 298 24 696 U1 has a bimetallic snap-action disk which is fixed to a bimetallic connection. This bimetallic connection is arranged within a housing base adjacent to a fixed contact connection. The housing base can be covered by means of a cap made from, for example, plastic or
15 metal. The bimetallic snap-action disk bears a bimetallic contact which, within the housing, is in a contact-making, overlapping position with a fixed contact of the fixed contact connection.

20 In the event of, for example, an overcurrent causing the contacts to open by means of the bimetallic snap-action disk being snapped up or bent up, an isolating slide, which is spring-loaded by means of a spring element, moves between the contacts. As a result, the
25 bimetallic snap-action disk is prevented from snapping back into the contact-making, closed position even once said bimetallic snap-action disk has cooled down. A circuit, into which the circuit breaker has been inserted as a fuse element, in this case remains
30 interrupted.

Such a circuit breaker is used in particular as a fuse element in circuits in a motor vehicle and, for this purpose, is inserted into corresponding flat fuse bases
35 of the motor vehicle. Further application areas for such circuit breakers having a bimetallic snap-action disk are possible in domestic electrical appliances or the like.

In a circuit breaker known from US 4,573,031 A, the isolating slide is integrally connected with a pushbutton protruding beyond the housing, by means of which the isolating slide, after it has moved between
5 the contacts in the event of tripping, can manually be returned to its original position.

In a circuit breaker known from US 2002/0149464 A1, an additional luminous element for visual display of the
10 event of tripping, is arranged within a pushbutton housing and projects therefrom. According to US 4,630,020 A, such a luminous element can also be arranged completely within the pushbutton, which is of hollow design, or within the housing, at a distance
15 from the isolating slide, in the area of a housing opening covered with a transparent lid.

The invention is based on the object of specifying a circuit breaker which has been improved in terms of its tripping identification.

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This object is achieved according to the invention by the features of claim 1. For this purpose, an illuminated pushbutton is provided which is connected within the housing to the isolating element. As a
10 result, on the one hand tripping of the circuit breaker is displayed visually in the form of a light signal which is visible from the outside. In addition, on the other hand, as a result of the coupling between the illuminated pushbutton and an isolating element, which
15 is displaced between the contacts in the event of tripping, it is also possible for the pushbutton position, which protrudes further out of the switch housing, in comparison with a normal, fault-free position, by the displacement path of the isolating
20 element, to be detected mechanically or manually from the outside. In addition, the pushbutton, by means of its actuation, is used to guide the isolating element back out of the contact isolating position, with the result that the contacts reach the contact position as
25 a result of the spring force of the bimetallic snap-action disk.

Within the housing, i.e. within the housing base in the case of a housing base which can be covered by means of
30 a housing cap, the pushbutton is mechanically coupled to the isolating element which is in the form of a slide. A latching or snap-action connection is provided for this purpose. In this case, the pushbutton expediently bears at least one, preferably two latching
35 arms having end-side latching cams, which engage in corresponding cutouts in the isolating element for the purpose of producing the latching or snap-action connection. It is also possible for the latching cams

to be provided on the isolating element and for the latching cutouts to be provided on the pushbutton.

In order to illuminate the pushbutton, an electrical
5 luminous element, for example a lamp or a light-emitting diode, is provided. The luminous element is arranged such that it is fixed in position in the housing or housing base. In this case, the luminous element can be connected within the housing between the
10 bimetallic connection and the fixed contact connection. With this wiring variant, the luminous element has current flowing through it when the bimetallic snap-action disk has been tripped, with the result that, in the OFF state, i.e. when the circuit breaker has been
15 tripped, the pushbutton is illuminated.

In accordance with one alternative wiring variant, contact is made between one connection of the luminous element and the bimetallic connection within the
20 housing, while the second connection of the luminous element is passed out of the housing base. In this variant, in which the luminous element connection which is passed to the outside is connected, for example, to a neutral conductor of a power supply system, in the
25 normal state, i.e. in the contact-making, overlapping position of the contacts and with corresponding external wiring of the circuit breaker, the luminous element has current flowing through it, with the result that the pushbutton illuminates in the ON state and
30 fails to be illuminated in the event of the contacts opening (OFF state).

The luminous element is arranged within the housing or housing base in the region of a material cutout in the
35 pushbutton. Owing to this material cutout, a pushbutton shaft and a pushbutton section, which protrudes beyond said pushbutton shaft and always at least partially protrudes beyond the luminous element even when the

contacts are opened, is formed along the pushbutton. In this case, the shaft length is matched to the displacement path of the isolating element which is coupled to the pushbutton, with the result that the pushbutton, with its pushbutton shaft, can move or can be displaced in a contactless manner along the stationary luminous element. In this case, the gap formed between the pushbutton section and the luminous element is increased in the event of tripping by the displacement path of the isolating element or the pushbutton coupled to said isolating element.

The pushbutton and the isolating element, which moves between the contacts in the event of tripping, form a two-part isolating slide in the latched coupling state, in which case different materials are expediently used for the two parts of this isolating slide. The isolating element, which, in the installed state, bears against the bimetallic contact and/or against the fixed contact, is thus made from a very thermally resistant plastic, i.e. a plastic which is resistant to thermal deformation, expediently from a thermosetting plastic. On the other hand, the pushbutton is made from a transparent material, preferably from a transparent plastic. This ensures that the light emitted from the luminous element passes to the outside via the pushbutton shaft and/or the pushbutton section, which protrudes beyond said pushbutton shaft, of the pushbutton.

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In order to achieve a degree of prefabrication which is as high as possible and using as few individual parts as possible, the fixed contact connection and the bimetallic connection are in the form of identical flat contacts. In their central region, these contacts are bent out in the manner of a trough. The trough thus formed is then either used for fixing the bimetallic snap-action disk or for accommodating the fixed

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contact. For this purpose, the two identical flat contacts are inserted into the housing base, rotated through 180° with respect to one another - in relation to their longitudinal axis - and are fixed there
5 expediently by means of connecting rivets. When using tubular or hollow rivets, they take on the further function of receiving the connections or the individual connection of the luminous element in a contact-making manner.

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The advantages achieved by the invention consist in particular in the fact that illumination which is integrated in a pushbutton of an isolating slide, which can be actuated from the outside via said pushbutton,
15 of a circuit breaker having a bimetallic snap-action disk makes it possible in a simple manner to achieve reliable tripping identification. The pushbutton thus takes on a dual function, which consists, on the one hand, in guiding the isolating element back out of the
20 contact isolating position when the pushbutton is actuated and, on the other hand, in optical signaling of an instance of the circuit breaker tripping as a result, for example, of an overcurrent.

25 Exemplary embodiments of the invention will be explained in more detail below with reference to a drawing, in which:

figures 1 and 2 each show a circuit breaker having a
30 bimetallic snap-action disk and illuminated pushbutton with the housing base covered or uncovered,
figure 3 shows the circuit breaker shown in figure 1 in an exploded illustration with the isolating slide decoupled to
35 give the pushbutton and the isolating element,

figures 4 and 5 show a side view and a front view, respectively, of the isolating slide, and

5 figures 6 and 7 show two different circuit variants of a luminous element inserted into the housing base.

Mutually corresponding parts are provided with the same references in all figures.

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The circuit breaker 1 shown in figures 1 to 3 comprises a housing base 3, which can be covered by a housing cap 2 and in which a bimetallic connection 4 and a fixed contact connection 5 are arranged parallel adjacent to one another. The connections 4 and 5, which are passed out of the housing base 3 on the connection side with their connections ends 4a and 5a, respectively, are fixed within the housing base 3 by means of hollow rivets 6.

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As can be seen in figure 3, the connections 4 and 5 are in the form of identical flat contacts and are bent back so as to form a trough 4b, 5b. In the respective trough apex, the connections 4b, 5b are provided with openings 7. In the installed state, the openings 7 in the case of the bimetallic connection 4 are used for fixing a bimetallic snap-action disk 8 by means of a rivet 9 and, in the case of the fixed contact connection 5, are used for accommodating a fixed contact 10. The bimetallic snap-action disk 8 bears a bimetallic contact 12 at its contact end 11 facing away from the bimetallic connection 4. In the installed state, this bimetallic contact 12 is in the contact-making, overlapping position with the fixed contact 10 (figure 2).

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A two-part isolating slide 13 is arranged between the bimetallic connection 4 and the fixed contact

connection 5 within the housing base 3, which is expediently made from plastic. Said two-part isolating slide 13 comprises an L-shaped isolating element 14 and a pushbutton 15, which is mechanically coupled to said isolating element 14. A latching or snap-action connection provided for this purpose is formed by two latching arms 16, which, in the exemplary embodiment, are provided on the pushbutton 15 and bear mutually facing cams 16a on the free-end side. The pushbutton 15 is snapped onto the isolating element 14 by means of the latching arms 16, in which case the latching cams 16a engage in corresponding latching cutouts 17 in the isolating element 14. This can be seen relatively clearly in figure 5.

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As shown in a side view of the isolating slide 13 in figure 4, the pushbutton 15 has a material cutout 18 so as to form a pushbutton shaft 15a and a pushbutton section 15b which protrudes beyond said pushbutton shaft 15a. In the final mounted state, a luminous element 19, for example a luminaire or a light-emitting diode, is positioned in said material cutout 18. The pushbutton 15 is made from a transparent material, preferably from a transparent plastic.

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In each displacement position of the isolating slide 13, which position extends in the direction of the arrow 20 (figure 4), the luminous element 19 is at least partially overlapped by the pushbutton section 15b of the pushbutton 15 such that, in any position of the isolating slide 13, the light emitted by the luminous element 19 passes to the outside, i.e. to outside the switch housing 2, 3, via the pushbutton shaft 15a and/or the pushbutton section 15b of the pushbutton 15.

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The isolating slide 13 has the function of moving between the two contacts 10, 11 in the event of the

circuit breaker 1 having been tripped, for example, by means of an overcurrent, as a result of which the contact end 11 with the bimetallic contact 12 moves away from the fixed contact 10 owing to the bimetallic
5 snap-action disk 8 opening or bending up. For this purpose, the isolating slide 13 is spring-loaded with a spring element 21. The spring element 21 is in this case supported on one side on the underside 22 of the isolating element 14, which underside 22 is remote from
10 the pushbutton 15, and on the other side on the housing base 3. The electrically insulating isolating function is taken over by the isolating limb 14a, which extends transversely with respect to the shaft extent of the pushbutton 15, of the isolating element 14, which
15 merges at right angles with the shaft 14b, which bears the latching cutouts 17, of the isolating element 14.

The isolating element 14 itself is made from a temperature-resistant plastic material or a plastic
20 material which is resistant to thermal deformation, preferably from a thermosetting plastic. The reason for this is the fact that the isolating element 14 is always at least approximately in touching contact with the contacts 10, 12 which carry current during
25 operation.

In the tripping-free ON state of the circuit breaker 1 illustrated in figure 2, the isolating limb 14b of the isolating element 14 bears against the contacts 10, 12
30 on the underside, which is remote from the pushbutton 15, of said contacts 10, 12. In the event of tripping, in the case of which the bimetallic contact 12 is lifted off from the fixed contact 10 as a result of the bimetallic snap-action disk 8 bending up or snapping
35 up, the isolating slide 13 is displaced in the displacement direction 20 as a result of the spring force brought about by the spring element 21 and is guided precisely between the two contacts 10, 12 whilst

forming an abutment or stop within the housing base 3. As a result, the two contacts 10, 12 are mechanically spaced apart from one another and electrically insulated from one another.

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As a result of this pushing movement of the isolating slide 13, the pushbutton 15 is displaced by the same displacement path in the displacement direction 20 owing to the fact that it is coupled with said
10 isolating element 14, and in the process is guided over the housing cap 2 towards the outside of the switch housing 2, 3 through this displacement path. In this final tripping position of the isolating slide 13, the pushbutton 15 protrudes beyond a dome-like pushbutton
15 sleeve 23 placed onto the housing cap 2. This pushbutton sleeve 23 may be an integral component of the housing cap 2 or may be snapped onto it as a separate part.

20 In the event of tripping, isolation of the contacts 10, 12, owing to the isolating slide 13 pushed between them, is maintained until the isolating element 14 is displaced in the opposite direction to the displacement direction 20 owing to the pushbutton 15 being
25 depressed. As a result of the spring force of the bimetallic snap-action disk 8 once it has cooled down, the bimetallic contact 12 is as a result again pressed against the fixed contact 10. In this contact-making, overlapping position, the isolating slide 13 is held in
30 its initial position in which it has been guided back and which corresponds to the ON state of the circuit breaker 1.

In accordance with the wiring for the luminous element
35 19 which can be seen comparatively clearly in figure 2, a first connection 19a is passed out of the housing base 3 via an ohmic resistor 24 so as to form an external supply connection 25. The supply connection 25

is in this case expediently passed out on the same housing side of the housing base 3, on which the connection ends 4a, 5a of the connections 4 and 5, respectively, also lie. The further connection 19b of the luminous element 19 is guided into the hollow rivet 6, which fixes the bimetallic connection 4 within the housing base 3, and makes electrical contact with the bimetallic connection 4 via said hollow rivet 6, for example makes plugging contact with the hollow rivet 6 or is soldered to it.

With the wiring variant illustrated in the form of a block diagram in figure 6, in which the luminous element connection 19a, which is passed to the outside, is connected, for example, to a neutral conductor of a power supply system, the luminous element 19 has current flowing through it in the normal state, i.e. in the contact-making, overlapping position of the contacts. With corresponding external wiring, the pushbutton thus illuminates in the ON state and is not illuminated in the OFF state when the contacts 10, 12 are open.

In accordance with a further wiring variant shown in figure 7, the luminous element 19 can also be wired exclusively within the housing in a manner which is not illustrated in any more detail. For this purpose, the connection 19a, which is passed to the outside in accordance with the variant shown in figures 2 and 6, of the luminous element 19 is passed in an electrically contact-making manner into the hollow rivet 6, which fixes the fixed contact connection 5, in an analogous manner to the plugging contact-making of the connection 19b. In this case, the luminous element 19 can in turn be switched on using a series circuit comprising the nonreactive resistor 24 and the luminous element 19 between the bimetallic connection 4 and the fixed contact connection 5. In this wiring variant, the

luminous element 19 has current flowing through it when the bimetallic snap-action disk 8 has been tripped, with the result that the pushbutton 15 is illuminated in the OFF state and is not illuminated in the ON state.

With both wiring variants, but in particular with the wiring variant shown in figures 2 and 6, instead of open wiring for the luminous element 19 and the resistor 24, said resistor 24 and the soldered joint formed between said resistor 24 and the connection 19a can be covered by shrinkdown tubing (not illustrated). As a result, undesirable electrical contact-making is reliably avoided.

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The circuit breaker 1 described having an illuminated pushbutton 15 is suitable for a large number of application areas, for example as motor, transformer or cable drum protection.

List of references

1	Circuit breaker	21	Spring element
2	Housing cap	22	Underside
3	Housing base	23	Pushbutton sleeve
4	Bimetallic connection	24	Resistor
4a	Connection end	25	Connection
4b	Trough		
5	Fixed contact connection		
5a	Connection end		
5b	Trough		
6	Hollow rivet		
7	Opening		
8	Bimetallic snap-action disk		
9	Rivet		
10	Fixed contact		
11	Contact end		
12	Bimetallic contact		
13	Isolating slide		
14	Isolating element		
14a	Isolating limb		
14b	Shaft		
15	Pushbutton		
15a	Pushbutton shaft		
15b	Pushbutton section		
16	Latching arm		
16a	Latching cam		
17	Latching cutout		
18	Material cutout		
19	Luminous element		
19a,b	Connection		
20	Arrow/displacement direction		

Claims

1. A circuit breaker (1) having a bimetallic snap-
5 action disk (8), which is fixed to a bimetallic
connection (4), which is arranged within a housing
(3) adjacent to a fixed contact connection (5), and
whose contact end (11) bears a bimetallic contact
(12), which is in a contact-making, overlapping
10 position with a fixed contact (10) of the fixed
contact connection (5), in the event of the contacts
opening, a spring-loaded isolating slide (13) moving
between the contacts (10, 12) and the isolating
slide (13) comprising an illuminated pushbutton
15 (15),

characterized in that
an electrical luminous element (19), which is
provided for the purpose of illuminating the
pushbutton (15), is arranged such that it is fixed
20 in position in the housing in the region of a
material cutout (18) in the pushbutton (15), and
that the pushbutton (15) is made from a transparent
material.

25 2. The circuit breaker as claimed in claim 1,
characterized in that,
owing to the material cutout (18), a pushbutton
shaft (15a) and a pushbutton section (15b), which
protrudes beyond said pushbutton shaft (15a) and
30 always at least partially protrudes beyond the
luminous element (19), are formed.

3. The circuit breaker as claimed in claim 1 or claim
5 2,

characterized in that

the pushbutton (15) is connected within the housing
to an isolating element (14), so as to form the
isolating slide (13).

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4. The circuit breaker as claimed in any of claims 1 to
3,

characterized in that

15 the luminous element (19) is connected within the
housing between the bimetallic connection (4) and
the fixed contact connection (5).

5. The circuit breaker as claimed in any of claims 1 to
3,

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characterized in that

a first connection (19a) of the luminous element
(19) is passed out of the housing (3), and contact
is made between the second connection (19b) and the
bimetallic connection (4) within the housing.

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6. The circuit breaker as claimed in any of claims 1 to
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characterized in that

30 the isolating element (14) is made from a thermally
resistant plastic and/or a plastic which is
resistant to thermal deformation.

7. The circuit breaker as claimed in any of claims 1 to
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characterized in that
the fixed contact connection (5) and the bimetallic
connection (4) are in the form of identical flat
contacts and are bent out in the central region in
10 the manner of a trough, the flat contacts (4, 5)
being inserted into the housing (3), rotated about
their longitudinal axis, such that the bimetallic
snap-action disk (8) is fixed to the outside of the
trough (4b) of the bimetallic connection (4) and the
15 fixed contact (10) is fixed to the inside of the
trough (5b) of the fixed contact (5).