

Description

The invention concerns a protective circuit breaker with the features of the introductory part of claim 1.

Such protective circuit breakers are known, for example from the EP 0 391 086 A1. A U-shaped bimetal, with an extension acting as a conductor bar that is also U-shaped, is there disposed electrically in series. In this arrangement, the conductor bar flanks the bimetal in such a way that the current directions of the sections of the conductor bar and bimetal lying opposite each other in the deflection plane of the bimetal are opposed to each other. Because of these opposed current directions, the bimetal and the conductor bar strongly repel each other, with high currents in particular. Since the conductor bar is fixed in the casing of the protective circuit breaker, the repelling forces act to their full extent as additional electrodynamic forces on the bimetal, so as to bend it out in its deflection plane. The relatively slow thermally conditioned deflection movement of the bimetal is therefore supported by the electrodynamic force effect. Since this effect occurs in particular at very high currents, a particularly short switching-off time is obtained in the case of a short circuit. In the case of low currents, the electrodynamic force effect is only subordinate, or not effective at all.

In the case of the known bimetal-controlled protective circuit breaker, the bimetal may be subjected to overloading due to unduly high currents. It will be destroyed, or at least impaired in its tripping accuracy or sensitivity. By this means, a reliable mode of operation of the protective circuit breaker is not ensured. To avoid this risk, known protective circuit breakers can only be used in a very limited spectrum of diverse current intensities. For diverse current intensities, it may possibly be necessary to use several protective circuit breakers.

To prevent overloading in the case of high current intensities, the bimetal may, for example, be given a more robust design by enlarging its cross-section. However, a more robust design impairs its tripping sensitivity and accuracy.

Starting with these drawbacks, the invention is based on the problem of constructing a bimetal-controlled protective circuit breaker in such a way that it is suitable for higher current intensities. Additionally, the tripping sensitivity and accuracy of the bimetal are to be improved. This problem is solved by the combination of the features of claim 1.

Because of the current shunt path disposed electrically parallel to the bimetal, the protective circuit breaker is suitable for a wide spectrum of various current intensities, without any need for changing the bimetal. The required maximum admissible current intensities are allowed for in a simple way by means of an appropriate line resistance of the shunt current path. This is

5 effected in the known way by varying lengths or dimensions of the cross-section, or even by choosing a different material for the shunt current path. Depending on the design requirements placed on the protective circuit breaker, as well as the existing manufacturing devices for the shunt current path, it is advantageous to vary the length, the cross-section or the specific resistance of the shunt current path.

10 One and the same protective circuit breaker is therefore suitable for all current ranges, simply by exchanging the shunt current path. With the exception of the shunt current path, the protective circuit breakers that can be used for various current spectra are designed to be identical as regards their technology and design. This reduces the manufacturing and
15 logistic costs of the protective circuit breakers.

20 As far as the manufacturing technology is concerned, it may be more advantageous to adapt the protective circuit breaker to various current intensities solely by the choice of a different bimetal. This has, moreover, the advantage that the maximum admissible current intensity of the protective circuit breaker and its tripping characteristic due to the heating of the bimetal, can be simultaneously altered in a simple way. The bimetals preferably differ only according to their material, while the
25 geometrical dimensions remain substantially the same. This facilitates the manufacture of the various bimetals. With protective circuit breakers differing in this way, there also do not arise any additional demands placed on the casing of the protective circuit breaker, which further simplifies the manufacture of protective circuit breakers.
30

35 It is also possible to adapt the protective circuit breaker to different current intensities by changing the bimetal and the shunt current path and/or the conductor bar.

40 The shunt current path disposed in parallel has, moreover, the effect that the cross-section of the bimetal can be reduced without overstressing its material by any overcurrent. A bimetal with a smaller cross-section has improved spring properties for its deflection. The spring characteristics of the bimetal are characterized by its section modulus which depends on the width and thickness of the bimetal. In this connection, the width affects the section modulus as a linear factor and the thickness as a quadratic factor. The spring characteristics
45 of the bimetal improved in this way, result in an improvement of the electrodynamic force of the conductor bar acting on the bimetal. The thermally conditioned deflection movement of the bimetal is also facilitated. The tripping sensitivity of the bimetal is therefore increased, and shorter tripping periods are obtained. The required or desired tripping characteristic can
50 therefore be allowed for in a simple way by means of bimetals with different cross-sections.

55 A shunt current path, designed in accordance with the invention as a shunt rail, also produces with an appropriate parallel arrangement relative to the bimetal an electrodynamic force be-

tween the shunt rail and the bimetal, in which arrangement the electrodynamic force acts to its full extent on the bimetal by means of the rigid shunt rail fixed in the casing of the protective circuit breaker. By this means the tripping sensitivity of the protective circuit breaker is further enhanced without additional components. In arranging the shunt rail, it is only the desired or required repulsion or attraction of the bimetal that has to be taken into consideration.

The parallel path of the bimetal, the shunt rail and the conductor bar additionally favour the space-saving design of the protective circuit breaker.

Claim 2 concerns a preferred mode of embodiment of the arrangement of the conductor bar, the bimetal and the shunt rail. With an appropriate direction of the current in the individual sections of the conductor bar, the bimetal and the shunt rail, there acts, for example, a repelling force between the bimetal and the conductor bar, so that the bimetal is deflected in the direction towards the shunt rail. This deflecting movement is supported by a force of attraction of the shunt rail acting on the bimetal. For this purpose, the shunt rail must be designed for a shunt current path producing the force of attraction. The enhanced electrodynamic force effect has the advantage that it is already acting in the case of rather small overcurrents and thereby further enhances the tripping sensitivity of the protective circuit breaker.

The conductor bar and the shunt rail arranged on opposite sides of the bimetal have a further favourable effect on the space-saving design of the protective circuit breaker. In contrast to an arrangement of both bars on one side of the bimetal, according to claim 2 the force effects of the two bars cannot affect each other. They act in each case independently on the bimetal with the maximum possible force.

Claims 3 and 4 concern further measures to improve the electrodynamic force effect on the bimetal.

According to claim 5, the bimetal has a U-shaped design. The U-plane is arranged at right angles to the plane of deflection, and the free ends of the U-arms acting as contact ends are fixed in position. The contact ends ensure, on the one hand, that the bimetal is arranged electrically in series in a simple manner. On the other hand, the one-sided mounting of the bimetal in the zone of their contact ends ensures that with the connecting yoke connecting the U-arms, a mechanically stable deflection end of the bimetal is created. By means of such a deflection end, one obtains a very effective force transmission of the deflected bimetal, for example, onto a switch latch for the reliable interruption of the circuit inside the protective circuit breaker.

By means of the U-arms of the bimetal and the conductor bar which, according to claim 5 is also U-shaped, the required current directions, moving in opposite directions or in the same

direction, are obtained within the bimetal and the two bars in a structurally simple manner, so as to obtain the electrodynamic forces required for an improved tripping characteristic.

5 According to claim 6 the bimetal, the conductor bar and the shunt rail are connected to one another by their contact ends or shunt contacts. In the case of the U-shaped design of the bi-
10 metal and of the two bars in accordance with claim 5, the free ends of the U-arms are preferably used as the contact ends or shunt contacts. Because of the parallel interspacing of the bi-
15 metal, the conductor bar and the shunt rail which is necessary for the electrodynamic force effects, a constructionally simple technique becomes possible for connecting these components in the zone of the free ends of the U-arms.

20 The connections act, on the one hand, as an electrical contact between the bimetal, the conductor bar and the shunt rail and, on the other hand, as a means for mechanically securing the components that are fixed in position to each other. Since the conductor bar and the shunt rail are fixed in the casing, the unit formed by the bimetal, the conductor bar and the shunt rail are sufficiently secured in the assembled state of the protec-
25 tive circuit breaker and are, therefore, well protected against external force effects. Nor do the bimetal, the conductor bar and the shunt rail, being one unit, have to be secured separately in the casing of the protective circuit breaker, so that additional fastening means are dispensed with. This has a saving effect as far as the components and costs are concerned. Moreover, the expenditure for assembly is kept low.

30 Because of the parallel interspacing between the bimetal, the conductor bar and the shunt rail that is necessary for an effective electrodynamic force effect, this compact unit has a narrow structural shape. The casing of the protective circuit
35 breaker can, therefore, be given smaller dimensions.

40 Claim 7 concerns a preferred mode of embodiment of the connection between the bimetal, the conductor bar and the shunt rail. Transition resistances between the bimetal, the conductor bar and the shunt rail are thereby reduced. Moreover, the weld joint renders a long service life possible for the bimetal, the conductor bar and the shunt rail as a compact unit.

45 According to claim 8, the unit is additionally secured on a supporting bracket. This promotes the mechanical stability of the unit in the assembled state. Since the supporting bracket forms a part of the circuit, it forms the second connecting contact for the unit apart from the conductor bar, so as to dispose the latter electrically in series with the circuit. Mechanically stable and electrical contact making connections between
50 the components are obtained by one and the same measure. This has a saving effect as far as the components and costs are concerned. The use of only a few components also makes it possible to give the casing of the protective circuit breaker smaller
55 dimensions.

Claim 9 concerns a preferred mode of embodiment of the fastening of the supporting bracket. This kind of fastening makes it possible for the supporting bracket to be placed into contact with a current line without the interposition of additional conductive components. This has again a saving effect as far as the components, costs and space are concerned. Moreover, additional transition resistances are avoided.

Claim 10 concerns a special mode of embodiment of the electrical contact between the supporting bracket and an external current line or of an electric consuming device.

The connecting pin fulfils a double function, on the one hand, as a mechanical fixing and securing means and, on the other hand, as an electrical contact means for the supporting bracket.

A supporting bracket designed according to claim 11 makes it possible to fulfil several functions. This also supports the space saving design of the protective circuit breaker.

The setscrew used permits the adjustment of the tripping sensitivity to be modifiable at all times. Thus one and the same protective circuit breaker can be tripped at different current rates.

The object of the invention will be explained in greater detail with reference to the examples of the embodiments represented in the drawings. There are shown in :

Fig. 1 an exploded representation of an overcurrent monitoring device,

Fig. 2 a rear view of parts of the overcurrent monitoring device according to Figure 1,

Fig. 3 a representation of the circuit within a protective circuit breaker in perspective,

Fig. 4 a top view of the overcurrent monitoring device in the final assembled state, with a partial representation of a casing of a protective circuit breaker.

The structure of the individual components of the overcurrent monitoring device will be explained with reference to Figure 1.

This is a bimetal unit with a U-shaped bimetal 1, a strip-type conductor bar 2 and a U-shaped shunt rail 3. The bimetal 1, the conductor bar 2 and the shunt rail 3 are arranged in planes that are parallel to one another.

The two U-arms 4, 5 of the bimetal 1 are arranged in a longitudinal direction 6. The base of the U forms the deflection end 7 of the bimetal 1 and extends in a depth direction 8 approximately at right angles to the longitudinal direction 6. In its zone remote from the arms 4, 5 of the bimetal, the deflection end 7 is bent by 45° in the direction towards the conductor bar

2. A bimetal projection 9 follows the zone of the deflection end 7 bent by 45°. As viewed in a transverse direction 10, extending perpendicularly to the longitudinal direction 6 and perpendicularly to the depth direction 8, the bimetal projection 9 is formed to be rectangular. It is arranged in a plane parallel to the arms 4, 5 of the bimetal. The bimetal projection 9 has in the depth direction 8 a shorter dimension than the deflection end 7 and is formed centrally at the end of the bent zone of the deflection end 7. The free ends of the arms 4, 5 of the bimetal are formed to be approximately square in the transverse direction 10 and form the contact ends 11, 12 of the bimetal. They are arranged with an offset in the direction towards the conductor bar 2 relative to the remaining zone of the arms 4, 5 of the bimetal. In the final assembled position, the conductor bar 2 covers the bimetal arm 4 as viewed in the transverse direction 10.

The plane of deflection of the bimetal 1 is formed by the longitudinal direction 6 and the transverse direction 10.

A bar extension 13 is integrally formed at the end of the conductor bar 2 facing the deflection end 7. As viewed in the depth direction 8, the bar extension 13 has an approximately square cross-section. The longitudinal dimension of the bar extension 13 corresponds to the depth direction 8. The conductor bar 2 and the bar extension 13 are arranged perpendicularly to each other. Together they are L-shaped.

The conductor bar 2 and the bar extension 13 are integrally produced from a metal strip. However, in the depth direction 8, this metal strip has only approximately half the width in the zone of the conductor bar 2 as in the zone of the bar extension 13. The outer zone of the conductor bar 2 facing the bimetal arm 4 in the depth direction 8 has a plurality of protrusions and slots respectively, which are rectangular as viewed in the transverse direction 10. The width of the bimetal 1 in the depth direction 8 is somewhat smaller than the corresponding dimension of the bar extension 13.

The shunt rail 3 is U-shaped, just like the bimetal 1. It is arranged in a plane parallel to the bimetal 1. The surface base of the shunt rail 3 projects beyond the two shunt arms 14, 15 in the depth direction 8. Its dimension in this direction is somewhat larger than the corresponding dimension of the bar extension 13. The two shunt arms 14, 15 and the arm ends 16, 17 following thereon approximately correspond in their shape and arrangement to the U-arms 4, 5 of the bimetal, as well as to their bimetal contact ends 11, 12.

However, the arm ends 16, 17 are extended by fastening ends 18, 19. The arm end 17 is extended by means of the fastening end 19 approximately in the longitudinal direction 6. But the fastening end 19 is bent away from the bimetal 1. As viewed in the transverse direction 10, the fastening end 19 is approximately square.

As compared with the associated shunt arm 14, the arm end 16 is longer in the depth direction 8. Thereon there follows, bent at right angles and directed towards the conductor bar 2, the fastening end 18. As viewed in the depth direction 8, the shape of the fastening end 18 is substantially rectangular (Figure 2). In its median zone, the fastening end 18 is pierced by a rectangular contact opening 20 in the depth direction 8. The surface of the conductor bar 2 facing the fastening end 18 contains, as has already been mentioned with reference to Figure 1, a plurality of slots and protrusions. At the bar end 21 of the conductor bar 2 remote from the bar extension 13, the contact protrusion 22 is formed extending in the depth direction 8. Its shape is matched to the shape of the contact opening 20 in such a way that in the final assembled state, a conjugate connection is established between the conductor bar 2 and the fastening end 18.

In its zone facing the arm end 17, the arm end 16 is pierced in the transverse direction 10 by an opening 23 for a screw. Its shape corresponds approximately to that of a semicircle with its concavity facing towards the arm end 17. In the final assembled state, the screw opening 23 allows a setscrew 24 (Figure 3) to pass with its insulating pin 25 through the arm end 16 without contact, and to act on the bimetal contact end 11 of the bimetal 1.

The cylindrical insulating pin 25 is centrally formed on the end face of the setscrew 24 facing the bimetal 1. The active direction of the setscrew 24 corresponds to the transverse direction 10. The setscrew 24 is mounted in a tapped bore 26. The tapped bore 26 passes in the transverse direction 10 through a mounting arm 27, not carrying any current, of a supporting bracket 28. In this direction, the mounting arm 27 has the shape of a rectangular plate. The mounting arm 27 has one rectangular cut out respectively in the zone of its corner edge facing the shunt arm 14 and the corner edge lying diagonally opposite thereto (Figure 3).

As viewed in the depth direction 8, a connecting arm 29 is integrally formed next to the mounting arm 27 on the supporting bracket 28. As viewed in the transverse direction 10, the shape of the connecting arm 29 is substantially rectangular. While the mounting arm 27 not carrying any current is arranged parallel to the arm end 16 of the shunt rail 3 in the final assembled state, the connecting arm 29 is bent in the direction towards the conductor bar 2. The connecting arm 29 and the fastening end 18, also bent relative to the arm end 17, are arranged in planes parallel to each other. A bimetal contact surface 30 extending parallel to the conductor bar 2 is integrally formed on the free end of the connecting arm 29,

As viewed in the transverse direction 10, the bimetal contact surface 30 is square. The plate-type bimetal contact surface 30 projects beyond the connecting arm 29 in the depth direction 8 on the side remote from the mounting arm 27.

A base component 31 forming part of the supporting bracket 28 is rectangular as viewed in the longitudinal direction 6. In the final assembled state, a connecting pin 32 (Figure 4) is placed in an electrical contact position. To connect the supporting bracket 28 and the connecting pin 32 with a form fit and with an electrical contact to each other, the base component 31 is pierced in the longitudinal direction 6 by a cylindrical pin opening 33.

In Figure 3, the bimetal component unit may be seen in its assembled state.

The bar end 21 is welded to the bimetal contact end 11 of the bimetal 1. The contact protrusion 22 of the conductor bar 2 is connected to the fastening end 18 of the shunt rail 3 by means of a form fit and is in electrical contact therewith. The bimetal contact end 12 of the bimetal 1 is welded to the bimetal contact surface 30. The same applies to the fastening end 19 of the shunt rail 3 and the connecting arm 29.

The end faces of the bimetal contact end 11 and of the arm end 16 facing each other are separated from each other by an air gap. For an additional insulation, an insulating plate may be introduced between these two end faces.

The bimetal projection 9 passes through a rectangular slide slot 34 of a slide 35. The slide 35 is mounted in the casing and extends in the plane formed by the depth direction 8 and the transverse direction 10. As viewed in the longitudinal direction 6, the slide 35 has a rectangular shape. The slide slot 34 is wider in the transverse direction 10 than the bimetal projection 9. Depending on the ambient temperature and the adjustment of the bimetal 1, the bimetal projection 9 lies within the slide slot 34 in different positions along the transverse direction 10.

To avoid short circuits, the slide 35 is produced from a material that is not electrically conductive.

The bar extension 13 and a contact lever 36 are connected to each other by an electrically conductive flex 52. The contact lever 36 consists of an electrically conductive material.

The contact lever 36 extends substantially in the transverse direction 10. In its end zone facing the bimetal 1, the contact lever 36 contains a mounting opening 37. It pierces the contact lever 36 in the depth direction 8.

The mounting opening 37 is traversed by a pin, not shown herein, secured in the casing and extending in the depth direction 8. By this means, the contact lever 36 is mounted fixed to the casing. A plate-shaped contact component 38 is secured on the surface of the contact lever 36 remote from the slide 35 in the longitudinal direction 6. The contact component 38 is arranged in the end zone of the contact lever 36 remote from the mounting opening 37 in the transverse direction 10.

A pin 39 extending in the longitudinal direction 6 is formed on the surface of the contact lever 36 connected to the contact component 38. As viewed in the transverse direction 10, the pin 39 is arranged between the mounting opening 37 and the contact component 38, but at a slight distance from the mounting opening 37. The pin 39 is surrounded with a form fit by a compression spring 40. The compression spring 40 acts against a surface, not shown herein, and thereby subjects the contact lever 36 to pressure in the longitudinal direction 6. The compression spring 40 helps the contact lever 36 to remain in this defined switched-on position (Figure 3) or in a defined switched-off position.

The contact component 38 cooperates with a fixed contact 41 for closing and opening the circuit. The fixed contact 41 is also plate-shaped. The fixed contact 41 is secured on a supporting base 42. As viewed in the depth direction 8, the supporting base 42 is a U-shaped metal strip. The U-arms extend in the transverse direction 10. The U base faces the bimetal 1. The fixed contact 41 is arranged in the end zone of the U-arm of the supporting base 42 facing the contact lever 36.

The end faces of the contact component 38 and of the fixed contact 41 facing each other in the longitudinal direction 6 form their contact surfaces. These contact surfaces extend approximately in the plane formed by the depth direction 8 and the transverse direction 10. When the end faces of the contact component 38 and of the fixed contact 41 bear on each other (Figure 3), the supporting base 42 is electrically connected to the bar extension 13.

The U-arm of the supporting base 42 remote from the contact lever 36 is pierced by a pin opening 43 in the longitudinal direction 6. It serves the same purpose as the pin opening 33 in the zone of the base component 31.

The bimetal contact end 11 of the bimetal 1 is subjected to pressure by means of the setscrew 24. The arms 4, 5 of the bimetal can be stressed with respect to each other by an adjustment of the setscrew 24. By this means, the bimetal 1 is adjusted and it is possible to set a variable tripping sensitivity.

To ensure that only the bimetal 1 is moved during the use of the electrodynamic forces, the conductor bar 2 is fixed in position in the zone of its bar extension 13, and the shunt rail 3 is fixed in position in the zone of its U-base within the casing of the protective circuit breaker. This mounting ensures that the conductor bar 2 and the shunt rail 3 are immovable relative to the bimetal 1 as required. At the same time, the conductor bar 2 is still movable in the zone of its bar end 21 and the shunt rail 3 in the zone of its arm end 16, in such a way that the pressure loading of the bimetal contact end 11 by means of the setscrew 24 is not impeded. To ensure that the bar end 21 is movable to some extent relative to the remaining zone of the conductor bar 2, the conductor bar 2 is dimensioned to be

smaller in the zone of its bar end 21 and its contact protrusion 22 by the step-type arrangement of cut outs in the depth direction 8.

5 A current starting from the supporting base 42 in the direction towards the conductor bar 2 divides in the zone of the bar end 21 (Figure 1). A part flows through the bimetal 1 from the bi-
10 metal contact end 11 to the bimetal contact end 12. The other part of the current flows through the shunt rail 3 from the fastening end 18 to the fastening end 19. In the zone of the connecting arm 29 of the supporting bracket 28, the two part
15 currents are again combined. The composition of the bimetal 1 is such that with low overcurrents, the deflection end 7 is deflected due to the thermal conditions in the direction towards one deflection side 44. The side remote therefrom is the rear
side 45.

20 While the thermally conditioned deflection movement of the bimetal 1 is effective primarily with low overcurrents, in the case of very high overcurrents, the bimetal 1 is deflected above all by the electrodynamic force effect. In the case of high
25 overcurrents, the electrodynamic force supports or replaces the relatively slow thermally conditioned deflection movement of the bimetal 1, so that in the case of a short circuit, the switching-off time is shortened, and the tripping characteristic of the protective circuit breaker is improved.

30 The conductor bar 2 and the bimetal arm 4 act like two parallel conductors traversed by the current in opposite directions. Such conductors repel each other because of the electrodynamic force effect. Since the conductor bar 2 and the shunt rail 3 are fixed in position, it is only the bimetal 1 that is moved with its deflection end 7 in the direction towards the deflec-
35 tion side 44.

40 For closing and opening the circuit within the protective circuit breaker, the slide 35 and the contact lever 36 cooperate with the switch latch 46 (Figure 3). The switch latch 46 is schematically represented as an approximately square box. It may consist of various electrical and mechanical components, for example, switches and levers. The directions of arrows 47, 48 indicate the cooperation of the slide 35 and the contact lever 36 with the switch latch 46.

45 The slide 35 acts for example, on a tripping means, not shown herein, of the switch latch 46. During the deflection movement of the bimetal 1, the bimetal projection 9 strikes the slide slot 34. By this means, the slide 35 mounted in the casing is moved in the direction towards the deflection side 44 (Figure
50 3). The switched position of the tripping means, not shown, ensures the completion of the pressure loading action of the switch latch 46 on the contact lever 36 in the direction towards the fixed contact 41. The contact lever 36 is rotated round the pin traversing the mounting opening 37 in an anticlockwise direction. The rotation of the contact lever 36 in an anti-
55 clockwise direction is supported by the compression spring 40.

The contact lever 36 thereby reaches its defined switched-off position.

For transferring the contact lever 36 into its switched-on position (Figure 3), an actuating element, not shown, may be provided on the switch latch 46. The actuating element can be switched by an operator. By this means, the switch latch 46 produces its pressure loading action on the contact lever 36. Thereby the contact lever 36 is rotated round the pin traversing the mounting opening 37 in a clockwise direction in the direction towards the fixed contact 41. The end faces of the contact component 38 and of the fixed contact 41 facing each other, bear on each other in the switched-on position of the contact lever 36. The circuit within the protective circuit breaker is thereby closed. The active direction of the contact pressure corresponds to the longitudinal direction 6. The contact pressure is additionally improved by the action of the compression spring 40.

The pressure loading action of the switch latch 46 on the contact lever 36 to ensure that it remains in its switched-on position (Figure 3) may be terminated by the operator, for example, by means of the actuating element (not shown). The switch latch 46 may also be connected to electronic means for controlling the switched position of the contact lever 36 by remote control.

The bimetal unit shown in Figures 1 to 4 is also suitable for current intensities above 50 A. Due to the shunt rail 3 disposed in parallel, the current is divided, which allows the cross-section of the bimetal 1 to be reduced. The reduction in cross-section provides improved spring characteristics of the bimetal 1, by means of which the electrodynamic force effect can be used in a better way.

In Figure 4 the bimetal unit is secured on a casing wall 49 of the protective circuit breaker. The connecting pin 32 traverses the wall 49 of the casing, as well as the base component 31, with a form fit and establishes in this way a firm mechanical connection between the wall 49 of the casing and the supporting bracket 28.

Due to its structure, the bimetal unit is a self-supporting compact and stable unit, and does not require any additional fastening means, apart from the supporting bracket 28 and the mounting of the conductor bar 2 and shunt rail 3 on the casing of the protective circuit breaker. Because of the necessary insulation, the whole casing of the protective circuit breaker, that is to say, also the casing wall 49 and a casing wall 50 disposed perpendicularly thereto, consists of an insulating material. An external current line or an electric consuming device may be connected to the connecting pin 32.

Figure 4 shows that the geometrical structure of the bimetal unit is well matched to the shape of the casing walls 49, 50. This space-saving design allows the protective circuit breaker

casing to have small dimensions. On the casing wall 50, a slide casing 51 is formed in the zone of the bimetal projection 9. The slide casing 51 extends in the transverse direction 10. The slide 35 is mounted in the slide casing 51. The movements of the slide 30 are guided in the transverse direction 10. The movements of all the components are executed in the deflection plane formed by the longitudinal direction 6 and the transverse direction 10. This also favours the space-saving design of the casing of the protective circuit breaker.

List of Reference Numerals

	1	bimetal
	2	conductor bar
5	3	shunt rail
	4	bimetal arm
	5	bimetal arm
	6	longitudinal direction
	7	deflection end
10	8	depth direction
	9	bimetal projection
	10	transverse direction
	11	bimetal contact end
	12	bimetal contact end
15	13	bar extension
	14	shunt arm
	15	shunt arm
	16	arm end
	17	arm end
20	18	fastening end
	19	fastening end
	20	contact opening
	21	bar end
	22	contact protrusion
25	23	screw opening
	24	setscrew
	25	insulating pin
	26	tapped bore
	27	mounting arm
30	28	supporting bracket
	29	connecting arm
	30	bimetal contact surface
	31	base component
	32	connecting pin
35	33	pin opening
	34	slide slot
	35	slide
	36	contact lever
	37	mounting opening
40	38	contact component
	39	pin
	40	compression spring
	41	fixed contact
	42	supporting base
45	43	pin opening
	44	deflection side
	45	rear side
	46	switch latch
	47	arrow direction
50	48	arrow direction
	49	casing wall
	50	casing wall
	51	slide casing
55	52	flex



PATENT CLAIMS

1. A bimetal-controlled protective circuit breaker with,
disposed in the electric circuit in series

- the bimetal (1) and

- a conductor bar (2) extending in the deflection plane of
the bimetal (1) parallel to the latter and being rigid as
compared with the bimetal (1), for supporting the de-
flection of the bimetal by an electrodynamic force effect,

characterized in that

- the bimetal (1) is disposed in parallel with a shunt rail
(3) as a shunt current path, which is rigid as compared
with the bimetal (1) so as to form a current division and

- that the rigid shunt rail (3) is also parallel to the bi-
metal (1) and extends in its plane of deflection.

2. A circuit breaker according to claim 1,

characterized in that

the shunt rail (3) is arranged on the side of the bimetal (1)
lying on the opposite side to the conductor bar (2).

3. A circuit breaker according to claim 1 or 2,

characterized by

a shape of the conductor bar (2) and/or shunt rail (3) that
approximately corresponds to the bimetal (1).

4. A circuit breaker according to one or more of the preceding
claims,

characterized in that

the conductor bar (2) and/or shunt rail (3) have an effective
length corresponding to the length of the bimetal (1).

5. A circuit breaker according to one or more of the preceding
claims with a U-shaped bimetal (1),

- whose U-plane is designed approximately at right angles to
the plane of deflection and

- whose U-arms (4, 5)



- are fixed in position with their bimetal contact ends (11, 12) and
- form with their connecting yoke the deflection end (7),

characterized by

a U-shape of the conductor bar (2) and/or shunt rail (3) as well, with the U-yoke connection respectively arranged on the same side.

6. A circuit breaker according to one or more of the preceding claims,

characterized in that

- the contact ends (11, 12, 21, 17), of the bimetal (1), of the conductor bar (2) and of the shunt rail (3) connected to the circuit and
- that the shunt contacts (18, 22) of the conductor bar (2) and of the shunt rail (3) are respectively connected to one another.

7. A circuit breaker according to claim 6

characterized in that

the connection is a weld connection.

8. A circuit breaker according to one or more of the preceding claims,

characterized in that

the unit formed by the bimetal (1), conductor bar (2) and shunt rail (3) on the main contact (19) of the shunt rail and/or on the bimetal contact end (12) in contact therewith, are mounted on a supporting bracket (28) disposed in the circuit.

9. A circuit breaker according to claim 8,

characterized by

a mounting of the supporting bracket (28) on a casing side (49) of the circuit breaker.

10. A circuit breaker according to claim 9,

characterized in that



the supporting bracket (28) is mounted on a connecting pin (32) of the circuit breaker, which serves for connecting an external current line or an electric consuming device.

5

11. A circuit breaker according to one or more of claims 8 to 10,

characterized in that

10

the supporting bracket (28) has

15

- a connecting arm (29) for the contact ends (12, 17, 19) of the bimetal (1) and of the shunt rail (3) as well as
- a mounting arm (27) not carrying any current, for the mounting of a setscrew (24) acting on the bimetal (1) for adjusting the tripping sensitivity of the circuit breaker.

20

KA7

25