

Description

Contact arrangement

The invention relates to a contact arrangement,

- having a contact unit for production of an electrical connection between a first contact, which is arranged in a fixed position on a withdrawable insert for a low-voltage switchgear assembly, and a second contact, which is arranged in a fixed position in the switchgear assembly, and
- having a means for movement of the contact unit from a disconnected position to a contact position and back,
- in which the contact unit has at least one contact element and at least one contact spring which prestresses the contact element in a sprung manner.

Moveable contact units such as these are being provided ever more frequently for withdrawable inserts of low-voltage switchgear assemblies, in order to make it possible to provide the various withdrawable-insert positions when the switchgear assembly door is closed and in order to make it possible in this way to guarantee a high level of personnel safety.

The movement capability of the contact elements was in this case achieved in the past, for example, by moving the contact units and by using flexible cables to bridge the path-length difference to the first contact. This solution has the disadvantage that, particularly when the current levels are relatively high, the flexible cables occupy a relatively large amount of space. In addition, these flexible cables must be laid and fixed carefully, in order to avoid damage.

The document DE 195 09 474 C2 discloses a contact arrangement which can be moved in a different manner, in which a

first contact surface of the contact element extends in such a manner that, during movement of the contact unit from the disconnected position to the contact position and back, it makes a sliding electrical contact with one of the contacts, and in which a second contact surface of the contact element extends in such a manner that, when the contact unit is located in the disconnected position, it is electrically disconnected from the other of the contacts, and when the contact unit is in the contact position, it makes electrical contact with the other of the contacts. - In this known contact arrangement, first contacts which are arranged in a fixed position on the withdrawable insert are in the form of rigid contact rails in order to be used not only for making electrical contact but also for mechanical guidance of a plurality of contact units. In this case, each of the contact units has two contact elements, which are prestressed against the contact rail by means of springs, with the springs being supported like rockers on a housing which is used as an opposing bearing, in order to mount the contact elements such that they can float. This floating mounting of the contact elements allows minor tolerance discrepancies with respect to the installation position of associated current busbars, which form the second contacts and whose contact planes run parallel to the contact planes of the contact rails.

Against the background of a contact arrangement as claimed in the precharacterizing clause of patent claim 1 (DE 195 09 474 C2), the invention is based on the object of designing the contact arrangement in such a manner that it allows two contacts to be electrically connected whose contact planes run at right angles to one another.

According to the invention, this object is achieved in that the first contact surface and the second contact surface on the contact element run at right angles to one another, in which case, in addition to one contact on which the contact element

slides, at least one stop element is provided, and has a stop surface which runs parallel to the second contact surface, and by means of which the contact element is mechanically guided.

In a refinement such as this, the plane in which the second contact surface of the contact element runs, in contrast to the plane on which the first contact surface runs, is not defined by the position of the one of the contacts but by the position of the stop surface. The first contact does not contribute to the part for guidance of the contact element, which defines the plane of the second contact surface.

One advantageous refinement of the novel contact arrangement provides for the at least one stop surface to be formed on the means for movement of the contact unit.

In this case, by way of example, the stop surface may be formed on a guide pin, which passes through a recess in the contact element.

It is advantageous for the at least one stop surface to be moveable at right angles to the second contact surface. - This allows the second contact surface to be moved to a desired plane in a mechanically simple manner. It is also advantageous that the entire contact unit can be moved in this way without any influence in the spring prestressing.

A further advantageous refinement of the novel contact arrangement provides for the means for movement of the contact unit to have a lateral slide and a bearing body which forms the stop element, with the bearing body being held on the lateral slide such that it can be moved at right angles to the second contact surface of the contact element.

- The guide pin may in this case be formed on the bearing body.

For electrical connection of a plurality of the first contacts to a plurality of the second contacts, the invention provides for a plurality of the bearing bodies to be held on the lateral slide such that they can be moved.

One preferred refinement of the novel contact arrangement provides for the contact element to be formed by a flat, U-shaped metal sheet. - In this case, the free ends of the U-shaped metal sheet may have a contact bulge on the mutually facing sides. In this case, one of the contact springs is preferably in the form of a U-shaped leaf spring, which prestresses the free ends of the U-shaped metal sheet with respect to one another in a sprung manner.

The stop element can also be fixed in a fixed position with respect to the one of the contacts, and may have appropriate attachment elements for this purpose. - In this case, the contact element can be guided in a simple manner by the stop element having a guide strip. Two flat faces of this guide strip are in this case used as stop surfaces for at least two of the contact elements which are in the form of contact fingers, with each of the two contact fingers being prestressed against one of the stop surfaces by means of in each case one spring.

The contact-making forces to be applied can advantageously be kept low by the guide strip being tapered at one of its ends, such that opposite contact fingers, which move along the strip, can be pivoted towards one another by the spring force.

The stop element is preferably in the form of a plastic molding.

With respect to a simple configuration and simple operation of the means for movement of the contact unit, it is advantageous for this to be held on the withdrawable insert - however, it may also be held on a frame of the switchgear assembly.

The invention will be explained in more detail in the following text with reference to embodiments of the novel contact arrangement which are illustrated in Figures 1 to 9, in which:

Figures 1 and 2 show a withdrawable insert for a low-voltage switchgear assembly, with a first embodiment of the contact arrangement located in the disconnected position and contact position, respectively;

Figure 2 shows the first embodiment of the contact arrangement, in the form of an exploded illustration,

Figure 3 shows the first embodiment of the contact arrangement in its disconnected position,

Figure 4 shows the first embodiment of the contact arrangement in its contact position,

Figures 5 to 10 show a second embodiment of the contact arrangement, in the disconnected position, intermediate position and contact position.

A withdrawable insert 1, which is shown in Figures 1 and 2, for a low-voltage switchgear assembly 2 comprises a first embodiment of contact arrangements 3, of which only four are shown, although a total of eight are provided. The contact arrangements 3 are shown in the contact position in Figure 1, and in the disconnected position in Figure 2. As can be seen

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from Figure 1, in the contact position, an electrical connection is made between first contacts 4 - which are in the form of

flat metal sheets - and second contacts 5 - which are in the form of rails and may be composed of copper.

As can be seen from Figure 3, the two flat metal sheets which form the first contacts are separated from one another by means of a spacer washer 6, and are prestressed with respect to one another by means of two leaf springs 7, in a sprung manner. The flat metal sheets which are provided with the leaf springs 7, the spacer washer 6 and a cable shoe 8 are connected via a screw connection 10 to form a first mechanical unit, and are held in a housing part 11 which is fixed in a fixed position on the withdrawable insert 1. In this case, the flat metal sheets have side projections 12, which engage in associated recesses 13 (see Figure 4) in the housing part in an interlocking manner, in order to fix the first mechanical unit on the withdrawable insert.

By way of example, a strip 14 with an H-shaped cross section can also be provided instead of the rail as the second contact, as is shown in Figures 4 and 5.

The contact arrangements 3 comprise a contact unit, which is annotated 15 as an entity in Figure 3, and a means for movement of the contact unit, which is annotated 16 as an entity in Figure 1.

The contact unit comprises a bearing body 17, two contact elements 18 and two contact springs 19. In this case, on the one hand, the first contacts are prestressed with respect to the contact elements 18 by the leaf springs 7. On the other hand, each of the two contact elements is prestressed with respect to the second contact 5 by in each case one of the contact springs 19 (see also Figure 3).

As can be seen in particular from Figure 1, the means 16 for movement of the contact unit 15 has two tooth rods 20 which run transversely at the front in the withdrawable insert 1 and can be moved sideways by a pinion 21. In this case, a key can be used to engage in the pinion 21, via the front face, at the point of the arrow 22. Strips 24 are moved forwards and backwards over corner fillets 23. A lateral slide 25 which is coupled to the strips 24 is then likewise moved forwards from the rear, and vice versa.

The contact unit 15 is guided by means of the lateral slide 25 in its movement direction 26. For this purpose, the lateral slide 25 engages in a groove 27 on the lower face of the bearing body 17, which extends transversely with respect to the movement direction 26 over the entire width of the bearing body 17. The bearing body 17 is thus mounted in a floating manner on the lateral slide 25 transversely with respect to the movement direction 26.

As can be seen in Figure 3, each of the contact elements 18 is formed by a flat, U-shaped, slotted metal sheet, in which the ends of the two limbs 28 each have a convex-curved contact bulge 29 on the mutually facing sides, by means of which they rest on the second contact 5 in the contact position (see Figure 5). While the flat faces of the metal sheets form first contact surfaces 31 which are associated with the first contacts 4, the edges of the contact bulges 29 form second contact surfaces 32, which are associated with the second contacts 5 and 14, respectively.

As can be seen in Figure 4, the two limbs 28 are prestressed with respect to one another in a sprung manner by means of the contact spring 19, which is curved in a U-shape and clasps the U-shaped metal sheet. The two limbs 28 each have an undercut, with the undercuts being located opposite one another in such a manner that

they form a retaining opening 34 with an essentially rectangular cross section. A guide pin 35, which is integrally formed on the bearing body 17, passes through this retaining opening 34 in an interlocking manner, so that the contact element 18 is held in the bearing body 17 such that it cannot rotate. The bearing body is thus a stop element, on which the side surfaces of the guide pin which run parallel to the second contact surface form stop surfaces 36, on which the contact elements 18 rest in an interlocking manner, and are thus guided.

As can be seen in Figures 4 and 5, in a disconnected position (see Figure 4), the first contact 4 extends essentially along the entire length of the first contact surface 31 of the contact element 18. In this case, a first contact 4 which are in the form of a flat metal sheet, each have contact studs 37 (see Figure 3) on the side facing the first contact surface 31, via which they make a continuous electrical contact with the first contact surface 31. The contact unit 15 can be moved from the disconnected position - in which the contact elements 18 are electrically disconnected from the second contacts 5 - to a contact position as shown in Figure 5 - in which the second contact surface 32 rests on the second contacts 14 subject to a spring force, and thus makes electrical contact. In this case, the first contacts 4 have an aperture slot 38, which is broader than the guide pin 35. The first contacts 4 are also narrower than the unobstructed internal width 39 of the bearing body 17, so that the lateral guidance of the contact elements 18 is not influenced by the position of the first contacts 4.

Figures 6 to 10 show a further embodiment of the novel contact arrangement.

In Figure 6, the second embodiment of the novel contact unit is annotated 40 as an entity, although only the lateral slide 43 of the means 41 for movement of the contact unit 42 is shown, since all the other elements essentially correspond to those in the first embodiment. In contrast to the first embodiment, the lateral slide 43 is in this case fitted with cylindrical pins 44, by means of which the contact unit 42 is moved.

The contact unit 42 comprises six contact elements 45 in the form of contact fingers, two contact springs 46 and a clamping frame 47. The two contact springs 46 are in this case each in the form of a leaf spring, and each have three fingers 48, which are each associated with one of the contact fingers, at both ends. The clamping frame 47 clasps the contact fingers and the leaf springs in such a manner that mutually opposite contact fingers are prestressed with respect to one another in a sprung manner.

Six first contacts 49 which are formed by flat metal sheets that are curved like tulips in pairs pass through window-like openings in a stop element 50. The metal sheets each have two contact studs 51 on the sides facing the contact fingers. These contact studs 51 rest against first contact surfaces 53 of the contact fingers, subject to the force of a spring 52, from a disconnected position to a contact position. On the side facing a second contact 54, the contact fingers have contact bulges 55, whose edges form second contact surfaces 56.

The metal sheets which form the first contacts 49, the spacer washers 57 and a cable shoe 58 are jointly connected to the stop element 50 via a screw connection 59 to form a second mechanical unit, and are held in a housing part 61 which is fixed in a fixed position on the withdrawable insert 60. In this case, the stop element 50 has attachment elements 62 in the form of lateral projections, which engage in an interlocking manner in associated recesses 63 in the housing part 61, in order to fix the second mechanical unit to the withdrawable insert.

The contact unit 42 can be moved from the disconnected position as shown in Figures 7 and 8 - in which the contact elements 45 are electrically disconnected from the second contacts 54 - to a contact position as shown in Figure 10 - in which the second contact surfaces 56 rest on the second contacts 56 subject to a spring force, and thus make electrical contact. In this case, the housing part 61 has aperture slots 64 for the cylindrical pins 44, which are broader than the cylindrical pins. The cylindrical pins 44 pass through aperture openings in the contact elements 45 and in the clamping frame 47 for movement of the contact unit 42. In this case, the lateral guidance for the contact elements 45 is provided by a guide strip 65, which is integrally formed on the stop element and whose two flat faces - which run parallel to the second contact surface - form stop surfaces 66 for three of the contact elements in each case. In this case, three contact elements 45 in each case rest, subject to the force of the springs 46, on in each case one of the stop surfaces 66 of the guide strip 65.

As can be seen in Figure 9, which shows an intermediate position of the contact unit, the guide strip 65 is designed to be slightly tapered on its side facing the second contact, and has two inclines 67. The contact bulges 56

slide along these inclines 67, as a result of which the contact elements 45 are moved towards one another on both sides of the guide strip 65, during which process they slide on the associated contact surfaces 68 of the second contacts 54 during this pivoting movement, in order in this way to reach the contact position as shown in Figure 10.

In both embodiments of the novel contact arrangement, the stop elements 17 or 50 may be in the form of a plastic molding.

Patent Claims

1. A contact arrangement (3; 40),
 - having a contact unit (15; 42) for production of an electrical connection between a first contact (4; 49), which is arranged in a fixed position on a withdrawable insert (1) for a low-voltage switchgear assembly (2), and a second contact (5; 54), which is arranged in a fixed position in the switchgear assembly, and
 - having a means (16; 41) for movement of the contact unit from a disconnected position to a contact position and back,
 - in which the contact unit (15; 42) has at least one contact element (18; 45) and at least one contact spring (19; 46) which prestresses the contact element in a sprung manner,
 - in which a first contact surface (31; 53) on the contact element extends in such a manner that it makes a sliding electrical contact with one (4; 49) of the contacts during movement of the contact unit from the disconnected position to the contact position and back, and
 - in which a second contact surface (32; 56) on the contact element extends in such a manner that it is electrically disconnected from the other (5; 54) of the contacts when the contact unit is in the disconnected position, and makes electrical contact with the other of the contacts when the contact unit is in the contact position, characterized
 - in that the first contact surface (31; 53) and the second contact surface (32; 56) on the contact element (18; 45) run at right angles to one another,
 - in which, in addition to one contact on which the contact element slides, at least one stop element (17; 50) is provided, and has a stop surface (36; 66) which runs parallel to the second contact surface (32; 56),

and by means of which the contact element is mechanically guided.

2. The contact arrangement as claimed in claim 1, characterized in that the at least one stop surface (36) is formed on the means (16) for movement of the contact unit (15).

3. The contact arrangement as claimed in claim 2, characterized in that the stop surface (36) is formed on a guide pin (35) which passes through a retaining opening (34) in the contact element (18).

4. The contact arrangement as claimed in one of claims 2 or 3, characterized in that the at least one stop surface (36) can be moved at right angles to the second contact surface (32).

5. The contact arrangement as claimed in one of claims 1 to 4, characterized in that the means (16) for movement of the contact unit (15) has a lateral slide (25) and a bearing body which forms the stop element (17), with the bearing body being held on the lateral slide (25) such that it can be moved at right angles to the second contact surface (32) of the contact element (18).

6. The contact arrangement as claimed in claim 5, characterized in that the guide pin (35) is formed on the bearing body.

7. The contact arrangement as claimed in one of claims 5 or 6, characterized in that

a plurality of the bearing bodies are held on the lateral slide (25) such that they can move.

8. The contact arrangement as claimed in one of claims 1 to 7,

characterized in that

the contact element (18) is formed by a flat, U-shaped metal sheet.

9. The contact arrangement as claimed in claim 8, characterized in that

the free limbs (28) of the U-shaped metal sheet have a contact bulge (29) on the mutually facing sides.

10. The contact arrangement as claimed in one of claims 8 or 9,

characterized in that

the contact spring (19) is in the form of a U-shaped leaf spring, which prestresses the free limbs of the U-shaped metal sheet against one another in a sprung manner.

11. The contact arrangement as claimed in claim 1, characterized in that

the stop element (50) has attachment elements (62), by means of which it can be fixed in a fixed position with respect to the one (49) of the contacts.

12. The contact arrangement as claimed in claim 11, characterized in that

the stop element (50) has a guide strip (65), with two flat faces of the guide strip being used as stop surfaces (66) for at least two of the contact elements (45) which are in the form of contact fingers, and with each of the two contact fingers being prestressed against one of the stop surfaces (66) by means of in each case one spring (46).

13. The contact arrangement as claimed in claim 12, characterized in that the guide strip (65) is tapered at one of its ends, such that opposite contact fingers, which move along the strip, can be pivoted towards one another by the spring force.

14. The contact arrangement as claimed in one of claims 1 to 14, characterized in that the stop element (17; 50) is in the form of a plastic molding.

15. A withdrawable insert (1) for a low-voltage switchgear assembly (2) having a contact arrangement (3; 40) for production of an electrical connection between a first contact (4; 49), which is arranged in a fixed position on the withdrawable insert, and a second contact (5; 54), which is arranged in a fixed position in the switchgear assembly, characterized in that the contact arrangement (3; 40) is designed as claimed in one of claims 1 to 14, with the means (16; 41) for movement of the contact unit being held on the withdrawable insert.

16. The withdrawable insert as claimed in claim 15, characterized in that the first contact (4; 49) is in the form of a flat metal sheet.

17. The withdrawable insert as claimed in claim 16, characterized in that the flat metal sheet is provided with contact studs (37; 51) on the side facing the contact element (18; 45).

18. The withdrawable insert as claimed in one of claims 16 or 17,

characterized in that

the flat metal sheet has projections (12) which extend at right angles to the movement direction (26) of the contact unit (15) and engage in associated recesses (13) in a housing part (11) which is fixed in a fixed position on the withdrawable insert (1).

19. A low-voltage switchgear assembly (2) having a withdrawable insert (1) and having a contact arrangement (3; 40) for production of an electrical connection between a first contact (4; 49), which is arranged in a fixed position on the withdrawable insert, and a second contact (5; 54), which is arranged in a fixed position in the switchgear assembly, characterized in that

the contact arrangement (3; 40) is designed as claimed in one of claims 1 to 14,

with the means for movement of the contact unit being held on a frame of the switchgear assembly.