A fastening element for fastening a support rail to a mounting base includes a block-type base member that is fastenable to the support rail and includes a through-hole. The fastening element also includes a connecting element disposed in the through hole of the base member. The connecting element is adapted to fasten the support rail to the mounting base and configured to extend through the support rail and the mounting base in a fastened state.
FASTENING ELEMENT AND METHOD FOR SECURING A SUPPORT RAIL TO A MOUNTING BASE

CROSS-REFERENCE TO RELATED APPLICATIONS


FIELD

[0002] The invention relates to a fastening element for fastening a support rail to a mounting base. The invention further relates to a method for fastening a support rail to a mounting base.

BACKGROUND

[0003] Electrical components, such as for example terminal blocks, are used for distributing electric power and electrical signals in the industrial sphere. They are mounted on a support rail within a switchgear. The support rail in turn is fastened to a mounting base, such as for example a mounting plate or a frame structure, which in turn is inserted into a switchgear cabinet. When fastening the support rail to the mounting base, it is important that the support rail have a secure mechanical seat on the mounting base, so that mechanical environmental factors, such as vibrations or jarring, do not result in a change in the position of the support rail and hence of the electrical components arranged on the support rail.

[0004] The support rail is usually fastened to the mounting base by means of a screw connection or rivet connection, with the screw or rivets used therefor being placed directly on the support rail in order to connect the support rail to the mounting base via bores which are already provided in the support rail and in the mounting base. In such case, it is necessary for the fastening point at which the fastening of the support rail to the mounting base occurs to be freely accessible to a tool. To this end, in the case of short support rails frequently a distance of approx. 20 mm from the first electrical components which are placed on is left free at the two opposite ends of the support rail. In the case of longer support rails which require one or more further fastening points, corresponding free spaces likewise have to be provided between the electrical components which are placed on. Only thus can it be ensured that the fastening point between the support rail and mounting base can be reached, as a result of which however the number of electrical components which can be mounted on the support rail is reduced. If no corresponding free space is to be provided, the support rail can be equipped with the electrical components only once the support rail is already fastened to the mounting base.

SUMMARY

[0005] In an embodiment, the present invention provides a fastening element for fastening a support rail to a mounting base. The fastening element includes a block-type base member that is fastenable to the support rail and includes a through-hole. The fastening element also includes a connecting element disposed in the through-hole of the base member. The connecting element is adapted to fasten the support rail to the mounting base and configured to extend through the support rail and the mounting base in a fastened state thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The present invention will be described in even greater detail below based on the exemplary figures. The invention is not limited to the exemplary embodiments. All features described and/or illustrated herein can be used alone or combined in different combinations in embodiments of the invention. The features and advantages of various embodiments of the present invention will become apparent by reading the following detailed description with reference to the attached drawings which illustrate the following:

[0007] FIG. 1 is a diagrammatic view of a fastening element according to an embodiment of the invention.

[0008] FIG. 2 is a diagrammatic view of a cut-out of the fastening element shown in FIG. 1 in the region of a mounting foot in a partial sectional view.

[0009] FIG. 3 is a diagrammatic view of a fastening element according to an embodiment of the invention, and

[0010] FIG. 4 is a diagrammatic sectional view of the fastening element shown in FIG. 3.

DETAILED DESCRIPTION

[0011] An aspect of the present invention provides for the improvement of the handling of support rails. In particular, an aspect of the invention permits the fastening of a support rail which is already equipped with electrical components, without having to provide for this a certain number of free spaces on the support rail for fastening the support rail to a mounting base.

[0012] In an embodiment, the present invention provides a fastening element for fastening a support rail to a mounting base which has a block-type base member which can be fastened to the support rail, with a connecting element being guided in a through-hole formed in the base member, via which connecting element the support rail can be fastened to the mounting base, with the connecting element being guided through the support rail and the mounting base in a fastened state.

[0013] In an embodiment of the invention the fastening of the support rail to a mounting base does not take place directly via a screw connection or rivet connection, but instead uses a separate component in the form of a fastening element which has a block-type base member which is provided with a through-hole in which is guided a connecting element via which the support rail can be fastened to the mounting base, for example a mounting plate or a frame structure. This fastening element, together with the electrical components which are to be placed on the support rail, is placed onto the support rail from above and is fastened to the support rail, for example by a clamping or latch-type connection, before the support rail is fastened to the mounting base. By placing the fastening element onto the support rail from above, the fastening element can be fastened to the support rail at any points whatsoever along the longitudinal axis of the support rail. Owing to the block-type configuration of the base member, the fastening element further lines up into the electrical components placed on the support rail, so that the electrical components can be fastened to the support rail directly adjacent to the fastening elements. "Block-type" in
this case means that the base member is not only in the form of a thin plate, but has a relatively great volume. Preferably the block-type base member is in the form of a thick disc which is placed on edge in the support rail. Due to the fact that the fastening element can be fastened to the support rail simultaneously with the electrical components, free spaces now no longer have to be provided between individual electrical components, so that the space available on the support rail can be used more effectively. At the same time, the mounting costs and the mounting time can be reduced. The base member of the fastening element is connected directly, for example via a screw connection or clamping connection, to the support rail. Additionally, the base member is connected to the support rail via the connecting element which is guided in the base member. The connecting element in this case is guided vertically to the longitudinal axis of the support rail in the base member. The connecting element forms a detachable connection to the support rail and the mounting base in that it is guided through the support rail and the mounting base, and may be for example in the form of a screw, a pin or a bolt. The fastening element according to the invention may furthermore be further formed such that it can also itself transmit electric power or electrical signals. For this purpose, for example bridge shafts can also be formed on the fastening element, via which bridge shafts the electric power or the signals can be looped through or routed. Further, the fastening element may also assume the function of an end retainer on a free end of the support rail. In this case, the fastening element may have a labelling surface by means of which a certain section of the support rail which is equipped with electrical components can be marked. Since the fastening element forms a secure connection to the support rail, the fastening element may also function as the contacting of a PE line between the support rail and the mounting base. As a result, it is possible for no contact points to be lost at other PE terminals which are otherwise provided on the support rail. Further, an illumination means, for example an LED bulb or a light guide, may also be arranged in the fastening element, via which means the support rail can be illuminated directly, which is advantageous in particular in switchgear cabinets which have little illumination.

According to an embodiment of the fastening element, the connecting element is formed to be self-tapping. "Self-tapping" means in this case that a lead-through in the form of a bore, through which the connecting element is guided, does not have to be already provided either on the support rail or on the mounting base before the fastening, but that the connecting element, by a vertical movement downwards towards the support rail and the mounting base, can drill through the support rail and the mounting base and thereby screw into them by cutting edges being formed on the connecting element. For example, the connecting element in this case may be formed as a self-drilling screw which is actuated by means of a tool, in particular a screwdriver, which can be introduced from above into the through-hole in the base member. Since this means that prior machining of the support rail and mounting base by drilling-in openings is dispensed with and thereby the number of working steps can be reduced, the entire mounting time can be reduced. In addition, this means that the flexibility of the fastening can also be increased, since the fastening element can be positioned and fastened at any point whatsoever along the support rail and hence along the mounting base.

Further, provision is made for the through-hole to have a shoulder formed as a bearing surface for an upper part of the connecting element. The upper part of the connecting element may for example be a head which has a greater diameter than the rest of the connecting element, which is preferably in the form of an elongate, round shank. Due to the shoulder formed in the through-hole, as a result of which a step is formed in the through-hole, the through-hole has two different diameters, with the diameter of the through-hole above the shoulder being greater than that beneath the shoulder. Owing to the shoulder which is formed as a bearing surface, the connecting element can be limited in its vertical movement in that the upper part of the connecting element upon a vertical movement of the connecting element in the direction of the support rail comes to lie on the shoulder. In addition, this can prevent the connecting element from being guided too far through the support rail and the mounting base and thereby projecting too far from the underside of the mounting base. Further, the shoulder means that when screwing-tight the connecting element which lies with its upper part already on the shoulder which is formed as a bearing surface, an additional pressure can be applied in the direction of the mounting base.

In order to prevent the connecting element from being able to slip out of the through-hole, for example during transport of the fastening element prior to mounting on a support rail, a loss prevention element for the connecting element is preferably formed in the through-hole. The loss prevention element is formed above the upper part of the connecting element in the through-hole, so that, if in addition a shoulder is formed in the through-hole, the upper part of the connecting element is arranged between the loss prevention element and the shoulder and also is movable only between the loss prevention element and the shoulder. The loss prevention element can be formed by a constitution of the diameter of the through-hole, which can for example be formed by a pin, a shoulder or a bulge.

A further particularly embodiment of the fastening element provides for the fastening element to have an outer contour which is matched to an outer contour of an electrical component which is to be arranged on the support rail. The fastening element thereby forms defined gripping surfaces by which automated handling is made possible, for example gripping rollers of a robot can grip the support rail together with the electrical components which are placed thereon by means of the fastening elements and can move them to the desired position, for example towards the mounting base. This means that the handling of a support rail can be substantially simplified. In addition, a configuration of the fastening element which has identical contours to the electrical components can even out the appearance of a support rail equipped with components. The outer contour can be formed for example by a housing which surrounds the base member, so that the housing preferably forms the entire outer surface of the fastening element, the housing preferably being formed from an insulating material, such as for example a plastics material. It is however also possible for the outer contour of the fastening element to be formed by the base member itself. In addition to the matched outer contour, reference patterns can also be provided on the fastening element for optical recognition by means of sensors or cameras on the fastening element.

Another embodiment of the invention provides a method for fastening a support rail to a mounting base, com-
prising the following steps: arranging a fastening element on the support rail, arranging a large number of electrical components on the support rail, placing the support rail on the mounting base, and fastening the support rail to the mounting base via the fastening element by actuating a connecting element which is guided in a base member of the fastening element, in that the connecting element is guided through the support rail and the mounting base.

[0019] In an embodiment, the invention is distinguished by a method in which, before the support rail is fastened to a mounting base, the support rail is first equipped with electrical components and one or more fastening elements according to the invention. The sequence of the arrangement of the electrical components and the fastening elements in such case may be selected in any order whatsoever. The finished equipped support rail can then be fastened to a mounting base via the connecting element which is guided in the base member of the fastening element, in that the connecting element is guided through the support rail and the mounting base. Due to the fact that the fastening element can be fastened to the support rail simultaneously with the electrical components, free spaces now no longer have to be provided between individual electrical components, so that the space available on the support rail can be utilised more effectively. At the same time, the mounting costs and the mounting time can be reduced. The base member of the fastening element is connected directly, for example via a screw connection or clamping connection, to the support rail. Additionally, the base member is connected to the support rail and preferably at the same time also to the mounting base via the connecting element which is guided in the base member. The connecting element in this case is guided vertically to the longitudinal axis of the support rail in the base member. The connecting element forms a detachable connection to the support rail and the mounting base, and may for example be in the form of a screw, a pin or a bolt.

[0020] According to an embodiment of the method, when the connecting element is being guided through the support rail and the mounting base, the connecting element automatically cuts into the support rail and the mounting base. For this, the connecting element is preferably formed to be self-tapping. “Self-tapping” means in this case that a lead-through in the form of a bore, through which the connecting element is guided, does not have to be provided already either on the support rail or on the mounting base before the fastening, but that the connecting element, by a vertical movement downwards towards the support rail and the mounting base, can drill through the support rail and the mounting base and thereby screw into the support rail and the mounting base by cutting edges being formed on the connecting element. For example, the connecting element in this case may be formed as a self-drilling screw which is actuated by means of a tool, in particular a screwdriver, which can be introduced from above into the through-hole in the base member. Since this means that prior machining of the support rail and the mounting base is dispensed with and thereby the necessary working steps can be reduced, the entire mounting time can be reduced. In addition, this means that the flexibility of the fastening can also be increased, since the fastening element can be positioned and fastened at any point whatsoever along the support rail and hence along the mounting base. Alternatively, it is of course also possible for a bore for guiding through the connecting element to be already provided in the support rail.

[0021] There are now a large number of possible ways of configuring and developing the fastening element according to the invention and the method according to the invention for fastening a support rail to a mounting base.

[0022] FIG. 1 shows a fastening element 1 for fastening a support rail to a mounting base, which element has a block-type, disc-shaped base member 2 in which a connecting element 3 is guided. The base member 2 is here formed in two parts, with an upper part 4 and a lower part 5, which are placed on one another and are interconnected. On the lower part 5 there is formed a mounting foot 6 via which the base member 2 can be connected to a support rail by latching or clamping the base member 2 to the support rail via the mounting foot 6 in the same manner as the electrical components are also latched and clamped to the support rail.

[0023] The outer contour of the base member 2 here corresponds substantially to the outer contour of an electrical terminal block which can be placed as an electrical component on a support rail. The fastening element 1 can thus be inserted with an identical shape into a row of electrical components placed on a support rail, as is shown in FIG. 7.

[0024] In the base member 2 there is formed a through-hole 7 which extends across the upper part 4 and the lower part 5 of the base housing 2 in which the connecting element 3 is guided. The through-hole 7 permits vertical guidance of the connecting element 3 relative to the longitudinal axis of the support rail on which the fastening element 1 is placed from above. For this, a tool can be introduced from above into the through-hole 7, by means of which tool the connecting element 3 can be actuated, for example by a rotary movement. The connecting element 3 in the embodiment shown here is in the form of a self-drilling screw which upon a rotary movement of the connecting element 3 automatically cuts in and screws itself into a support rail and an underlying mounting base, as is shown for example in FIG. 3.

[0025] FIG. 2 shows a cut-out of the mounting foot 6 of the fastening element 1 shown in FIG. 1. The mounting foot 6 shown here has a sheet-metal spring 8 in the form of a stirrup, by means of which particularly secure clamping of the fastening element 1 to a support rail can be achieved, so that lateral displacement of the fastening element 1 on the support rail can be prevented.

[0026] FIG. 3 shows a further possible embodiment of a fastening element 10 with a base member 12 which is formed in two parts, with the upper part 14 and the lower part 15 of the fastening element 10 being interconnected via screws 16a. The base member 12 is fastened to the support rail 20 via clamping blocks 18, which are likewise securely connected to the base member 12 via screws 16b. The upper part 14 and the lower part 15 of the base member 12 here in each case are in the form of a T-shaped block, so that the entire base member 12 has a plurality of steps, and is thus already matched to the shape of an electrical terminal block. The clamping blocks 18 are clamped from below against the outwards-bent free ends 21 of the U-shaped support rail 20, and the lower part 15 of the base member 12 lies from above on the outwards-bent free ends 21 of the U-shaped support rail 20, so that the free ends 21 of the U-shaped support rail 20 are clamped between a clamping block 18 and the lower part 15 of the base member 12 in each case. Around the base member 12 and the clamping blocks 18 there is arranged a housing 19, here shown in a sectional form, which almost completely encompasses the base member 12, the screws 16a, 16b which are screwed thereto and the clamping blocks 18, and thereby in the
embodiment shown here forms the outer contour of the fastening element 10. In the region of the screws 16a, 16b and the through-hole 17 formed in the base member 12, openings 22 are provided in the housing 19, so that the screws 16a, 16b and the connecting element 13 can be actuated with a tool via the openings 22. The connecting element 13, in the embodiment shown here too, is in the form of a self-drilling screw, it being shown in the embodiment shown in FIG. 3 how the connecting element 13 is guided through the support rail 20 and a mounting base 40, here in the form of a mounting plate, in order to fasten the support rail 20 to the mounting base 40.

FIG. 4 is a sectional view through the fastening element 10 shown in FIG. 3. In this case, it can be recognised that the through-hole 17 has a shoulder 24 which is formed as a bearing surface for an upper part 23, in particular a screw head, of the connecting element 17. The shoulder 24 here is formed in the upper part 14 of the base member 12. Due to the shoulder 24 which is formed in the through-hole 17, as a result of which a step is formed in the through-hole 17, the through-hole 17 has two different diameters, the diameter of the through-hole 17 above the shoulder 24 being greater than that beneath the shoulder 24. Owing to the shoulder 24 which is formed as a bearing surface, the connecting element 13 can be limited in its vertical movement downwards towards the support rail 20 by the upper part 23 of the connecting element 13 coming to lie on the shoulder 24. A further limitation of the vertical movement upwards of the connecting element 13 which is guided in the through-hole 17 is formed by a loss prevention element 25, which in the embodiment shown here is in the form of a bulge formed above the shoulder 24 on the inner wall 26 of the through-hole 17. This means that, in particular during transport of the fastening element 10, the connecting element 13 can be prevented from being able to slip out of the through-hole 17 at the top. The upper part 23 of the connecting element 13 is thus guided and movable between the shoulder 24 and the loss prevention element 25.

While the invention has been illustrated and described in detail in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive. It will be understood that changes and modifications may be made by those of ordinary skill within the scope of the following claims. In particular, the present invention covers further embodiments with any combination of features from different embodiments described above and below.

The terms used in the claims should be construed to have the broadest reasonable interpretation consistent with the foregoing description. For example, the use of the article “a” or “the” in introducing an element should not be interpreted as being exclusive of a plurality of elements. Likewise, the recitation of “or” should be interpreted as being inclusive, such that the recitation of “A or B” is not exclusive of “A and B,” unless it is clear from the context or the foregoing description that only one of A and B is intended. Further, the recitation of “at least one of A, B and C” should be interpreted as one or more of a group of elements consisting of A, B and C, and should not be interpreted as requiring at least one of each of the listed elements A, B and C, regardless of whether A, B and C are related as categories or otherwise. Moreover, the recitation of “A, B and/or C” or “at least one of A, B or C” should be interpreted as including any singular entity from the listed elements, e.g., A, any subset from the listed elements, e.g., A and B, or the entire list of elements A, B and C.

LIST OF REFERENCE NUMERALS

| A  | 0030 | Fastening element 1, 10 |
| A  | 0031 | Base housing 2, 12 |
| A  | 0032 | Connecting element 3, 13 |
| A  | 0033 | Top side 4, 14 |
| A  | 0034 | Underside 5, 15 |
| A  | 0035 | Mounting foot 6 |
| A  | 0036 | Through-hole 7, 17 |
| A  | 0037 | Sheet-metal spring 8 |
| A  | 0038 | Screw 16a, 16b |
| A  | 0039 | Clamping block 18 |
| A  | 0040 | Housing 19 |
| A  | 0041 | Support rail 20 |
| A  | 0042 | Free end 21 |
| A  | 0043 | Opening 22 |
| A  | 0044 | Upper part 23 |
| A  | 0045 | Shoulder 24 |
| A  | 0046 | Loss prevention element 25 |
| A  | 0047 | Inner wall 26 |
| A  | 0048 | Mounting base 40 |

1-7. (canceled)

8. A fastening element for fastening a support rail to a mounting base, the fastening element comprising:
   a block-type base member that is fastenable to the support rail and includes a through-hole; and
   a connecting element disposed in the through hole of the base member, the connecting element being adapted to fasten the support rail to the mounting base, the connecting element being configured to extend through the support rail and the mounting base in a fastened state thereof.

9. The fastening element as recited in claim 8, wherein the connecting element is self-tapping.

10. The fastening element as recited in claim 8, wherein the through-hole has a shoulder including a bearing surface for an upper part of the connecting element.

11. The fastening element as recited in claim 8, wherein the through-hole includes a loss prevention element for the connecting element.

12. The fastening element as recited in claim 8, wherein the fastening element has an outer contour which is matched to an outer contour of an electrical component, the electrical component being disposed on the support rail.

13. A method for fastening a support rail to a mounting base, the method comprising:
   disposing the support rail on the mounting base;
   arranging a plurality of electrical components on the support rail;
   providing a fastening element including a block-type base member with a through hole; and
   guiding a connecting element through the through hole, the support rail, and the mounting base so as to fasten the support rail to the mounting base.

14. The method as recited in claim 13, wherein the connecting element automatically cuts into the support rail and the mounting base when the connecting element is being guided through the support rail and the mounting base.

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