



Description

159159

Busbar arrangement for an electrical switchgear assembly

The invention relates to a busbar arrangement for an electrical switchgear assembly, in particular for an electrical switchgear assembly of double-front design.

For some time, switchgear assemblies have been designed not only as single-front arrangements but also as double-front arrangements. A double-front arrangement is constructed such that the assembly has an operator control panel both on the front face (at the front) and on the rear face (at the rear). A double-front arrangement also has a common busbar system. Field rails are connected to the common busbar, which is situated in the middle, from the front and from the rear here. In this case, the busbar is held by at least one busbar holder.

German patent specification DE 199 53 561 C1 discloses a conventional busbar arrangement without a double-front arrangement, which is distinguished in that it is suitable for a very wide variety of configurations of current conductors. In this case, the current conductors are accommodated in current conductor holders which comprise parallel, strip-like support pieces of insulating material and securing means which connect said support pieces.

German laid-open specification DE 103 32 679 A1 describes a multipole busbar system for switchgear assemblies of double-front design. In this case, the individual rails are arranged in one plane and at a specific minimum distance from one another.

Phase rails which are divided into a plurality of (usually two or four) conductor elements are often used in multiphase busbar arrangements. In the low-voltage range, division of this type is usually used to reduce



G00002

eddy current losses. For simultaneous connection of devices to the busbar from the front and rear, a complex system was required in order to prevent rail connections colliding with one another. Furthermore, one problem faced in the case of double-front arrangements in particular is that of providing a suitable busbar holder which permits connection from the front and from the rear without difficulty.

One object of the present invention is to provide a busbar holder which is of comparatively simple design and can be used universally and, in particular, in double-front arrangements.

This object is achieved by a busbar arrangement as claimed in claim 1. This claim makes provision for the busbar holder to be arranged between a first group of conductor elements and a second group of conductor elements.

In this case, the first group of conductor elements comprises at least two first (front) conductor elements and the second group of conductor elements comprises at least two second (rear) conductor elements. These four conductor elements are arranged in a rectangle, with the conductor elements of one group of conductor elements each preferably being arranged transverse to the longitudinal direction of the busbar and aligned with one another.

Since the busbar holder is arranged between the conductor elements, that is to say within the rectangle formed by the conductor elements, it does not extend beyond the conductor elements. Instead, it is of extremely compact design, so that it has a highly space-saving effect. According to the invention, the busbar holder is therefore not arranged on the outside of one or both sides of the busbar, as is known from the prior art, but instead is situated virtually in the intermediate space between the individual conductor elements of the busbar and holds the

PCT/EP2006/066450
2005P11115WOIN

- 2a -

conductor elements from the inside. This provides the largest possible connection region for the connection rails.

Since the outer faces of the conductor elements are therefore free, electrical connection from the front and from the rear, independently of one another, is possible without difficulty in order to realize a double-front arrangement. In other words, the busbar holder does not prevent two-sided connection of this type. Furthermore, this simple and therefore economical design solution means that the installation space required can be considerably reduced compared to known solutions. Considerably more space is therefore available in a switchgear cabinet or the like for other internal components for example. Finally, the invention also means that it is possible to use the same busbar holder for a very wide variety of busbars with different rail cross sections. The busbar holder can therefore be used for busbar cross sections of 20 x 5 to 50 x 10 for example, it also being possible to use more than one conductor element for each phase. In addition, the busbar holder according to the invention can be used both for single-front and double-front arrangements and also for "power-center arrangements" in which the busbar system is arranged in series twice (current-carrying capacity of up to 6300 A). Furthermore, the busbar holder can be used both for a busbar assembly at the rear, in the center and at the "power center", but can also be positioned to the left or right or in the symmetrical center at the top or bottom of a switchgear cabinet. This universal utility does not only mean that development and production costs can be reduced, but storage and provision costs can be reduced too. The considerable improvement in the short-circuit characteristics of the busbar holder which is arranged between the conductor elements is also advantageous. In the event of a short circuit, force is introduced into the busbar holder on account of the proposed solution in such a way that the busbar holder is barely exposed to any bending stress. The busbar holder according to the invention therefore needs to be designed only for the tensile forces which occur in the event of a short circuit. Since savings can therefore be made in terms of material selection

and the structural design of the busbar holder, the busbar holder can be produced in a considerably more economical manner. A further advantage can be seen in the universal applicability for phase and N/PEN conductors.

Advantageous refinements of the invention are specified in the subclaims.

According to a first embodiment of the invention, the busbar holder has two base body elements which are preferably identical. These base body elements are preferably connected to one another in such a way that a symmetrical design of the busbar holder is produced. However, with a straightforward design of the desired busbar holder, it is also possible to use an integral busbar holder. However, it is often easier to mount the conductor elements if a busbar holder having two base body elements is used. This applies predominantly when six conductor elements are used since in this case the central conductor element can be inserted and mounted between the two base body elements in a very simple manner if the base body elements are correspondingly loosely connected to one another for mounting the conductor elements.

According to a further embodiment of the invention, at least two third (central) conductor elements which are arranged between the first conductor elements and the second conductor elements are provided, these third conductor elements likewise each being arranged transverse to the longitudinal direction of the busbar and aligned with one another. As a result, current distribution for the busbar system can be improved, particularly in the case of relatively high rated currents. More uniform distribution of current in a conductor element arrangement of this type means that rail material (in particular copper) can be saved. Furthermore, a rated current of the busbar which is higher than in known solutions is possible in the case of double-front arrangements. The cross

PCT/EP2006/066450
2005P11115WOIN

- 4a -

sections for each phase can be designed for rated currents of above 4000 A for example.

It has been found that current distribution to the individual conductor elements in an arrangement with six conductor elements is very different on account of the skin effect. In particular, the central conductor elements carry scarcely any current. This results in an unfavorable ratio of cross section for each phase to current which can be transmitted. Therefore, according to a further embodiment of the invention, the central conductor elements can be formed in such a way that they protrude beyond the front and rear conductor elements transverse to the longitudinal direction of the busbar. In other words, the central conductor elements are offset toward the outside, are thus higher than the outer conductor elements and protrude beyond them. The fact that the central conductor elements are no longer at the same height as the outer conductor elements in the vertical direction means that current is distributed to the individual conductor elements for each phase in a very uniform manner, as demonstrated by measurements. Furthermore, greater current-carrying capacity with the same copper cross section can be achieved with this arrangement of the central conductor elements. The busbar holder then preferably has at least one receiving opening for receiving at least one conductor element of the third group of conductor elements. If only four conductor elements are used, the receiving opening, which is preferably in the form of a continuous receiving channel, can also be provided with a preferably nonconductive filler piece. These filler or intermediate pieces have a mechanical support function and thus ensure the stability of the entire structure, even under high loads.

Furthermore, a distinction can essentially be drawn between two basic concepts of the invention. Accordingly, it is firstly possible to hold the conductor elements by means of a guide on the busbar holder. In this case, the guide is formed using a securing bracket, without a hole or the like being required in the conductor elements. This solution is called the "bracket

PCT/EP2006/066450
2005P11115WOIN

- 5a -

solution" below. Secondly, it is also possible to connect, in particular to directly screw, the conductor elements directly to the busbar holder.

This solution, which is called the "screw solution" below, has the advantage that no separate mounting elements, for example the securing bracket, are required. However, the conductor elements have to be provided with openings for the screwing means for this solution. The two solutions have specific advantages and in practical tests exhibit excellent results in terms of economical production, simple mounting and secure attachment of the busbars.

The "bracket solution" is distinguished particularly in that at least one conductor element of the first or second group of conductor elements is situated in a guide on the outer face of the busbar holder. In this case, the guide is preferably formed firstly by a guide element which is arranged firmly on the outer face of the busbar holder and is preferably in the form of a web, and secondly by a securing bracket which can be mounted on the outer face of the busbar holder. In this case, the guide is preferably designed in such a way that the conductor element is situated firmly in the guide, but without having to be held by the guide element or securing bracket in a force-fitting manner in the sense of a press-fit connection. In other words, preferably only an interlocking connection exists. The conductor element is held in the guide.

In this context, it is particularly advantageous if the securing bracket is formed in such a way that it bears simultaneously against the two outer faces of the busbar holder. In other words, the securing bracket then surrounds the busbar holder, so that a guide for a conductor element is formed on both sides of the busbar holder, provided that a corresponding mating piece, for example a web-like guide element, is provided. As a result, the conductor element is secured to the busbar holder in a particularly reliable manner. The securing bracket equally holds the two base body elements of the busbar holder together, and thus also ensures that the entire structure is held together. A screw-connection,

which passes preferably fully through the limbs of the securing bracket, is preferably provided in order to fix the position and secure the securing bracket on the busbar holder.

Since the conductor element is situated in the guide preferably only in an interlocking manner, its position is secured by means of a screw-connection in a further embodiment of the invention. It is particularly advantageous when the screw-connection is made at the edge of the conductor element, since there is then no need to make an opening in the conductor element. The guide element advantageously has an opening for receiving that screw which fixes the conductor element in the guide.

A further embodiment of the invention according to which the receiving width of the guide can be varied in order to secure conductor elements of different sizes is very particularly advantageous and important for universal use. This is preferably realized in such a way that the busbar holder has a number of first mounting elements which are arranged next to one another in the longitudinal direction of the busbar holder on at least one outer face, and furthermore that the securing bracket has second mounting elements on at least one of its areas of contact with the busbar holder, said second mounting elements forming a guide with the first mounting elements in the mounted state. The mounting elements are preferably simple grooves and, respectively, prongs or lugs which form a type of groove-and-tongue connection by engaging in one another. The securing bracket can be mounted in a manner offset in terms of height on account of the fact that a whole series of such mounting elements are provided on the busbar holder. Therefore, both very narrow and also very wide conductor elements can be secured on the same busbar holder.

If busbars with three groups of conductor elements, in particular with six conductor elements, are used, the securing

PCT/EP2006/066450
2005P11115WOIN

- 7a -

bracket preferably has a spacer element which, in the mounted state, is situated in the receiving opening

of the busbar holder and forms a stop for a conductor element of the third (central) group of conductor elements. The offset in height of the central conductor elements which is required for a greater current-carrying capability can therefore be realized in a simple manner. The spacer element, which is preferably inserted into the receiving opening of the busbar holder, equally serves to stabilize the busbar holder and to securely hold the securing bracket on the busbar holder.

The "screw solution" is distinguished particularly in that the busbar holder and at least one conductor element of a group of conductor elements each have at least one securing opening for receiving a securing screw, and furthermore in that the conductor element bears against the outer face of the busbar holder and is connected to the busbar holder in a force-fitting manner on account of screw-on pressure so as to form a screw-connection.

A further embodiment of the invention according to which the busbar holder and/or the conductor element have/has a number of different securing openings for securing conductor elements of different sizes is very particularly advantageous and important for universal use. The securing openings are preferably distinguished here in terms of their position on the busbar holder or on the conductor element and/or in terms of their size. In this case, the securing openings are advantageously provided in such a way that, for example, conductor elements comprising 20 and 30 mm-wide copper rails can be screwed in a common securing opening, while conductor elements comprising 40 and 50 mm-wide copper rails can be screwed in another common securing opening which is at a distance from the abovementioned securing opening. In other words, the securing openings additionally have multiple "associations", so that unnecessary weakening of the rail material as a result of too many securing openings is avoided.

If busbars with three groups of conductor elements, in particular with six conductor elements, are used, the busbar holder has a spacer element in its receiving opening, which spacer element forms a stop for a conductor element of the third (central) group of conductor elements. The required offset in height of the central conductor elements can therefore again be realized in a simple manner. The spacer element equally serves to stabilize the busbar holder again.

The invention is described below with reference to exemplary embodiments which are explained in greater detail with the aid of drawings. In the drawings, in simplified, partly schematic illustrations:

- fig. 1 shows a plan view of a base body element ("bracket solution"),
- fig. 2 shows a side view of a base body element ("bracket solution"),
- fig. 3 shows a perspective view of a base body element ("bracket solution"),
- fig. 4 shows a perspective view of a securing bracket,
- fig. 5 shows a side view of a securing bracket,
- fig. 6 shows a plan view of a securing bracket,
- fig. 7 shows a perspective view of a holding plate,
- fig. 8 shows a side view of a busbar holder ("bracket solution") for a busbar with four conductor elements,
- fig. 9 shows a perspective view of a detail of a busbar holder ("bracket solution") for a busbar with four conductor elements,
- fig. 10 shows a side view of a busbar holder ("bracket solution") for a busbar with six conductor elements,
- fig. 11 shows a perspective view of a detail of a busbar holder ("bracket solution") for a busbar with six conductor elements,

fig. 12 shows an exploded perspective view of a busbar holder ("screw solution") with receiving openings,
fig. 13 shows a perspective view of a detail of a busbar holder ("screw solution") with receiving openings for a busbar with six conductor elements,
fig. 14 shows an exploded perspective view of a busbar holder ("screw solution") without receiving openings,
fig. 15 shows a perspective view of a detail of a busbar holder ("screw solution") without receiving openings for a busbar with four conductor elements,
fig. 16 shows a side view of a busbar holder ("screw solution") for a busbar with two conductor elements,
fig. 17 shows a side view of a busbar holder ("screw solution") for a busbar with four conductor elements (30 mm-wide copper rails),
fig. 18 shows a side view of a busbar holder ("screw solution") for a busbar with four conductor elements (50 mm-wide copper rails), and
fig. 19 shows a side view of a busbar holder ("screw solution") for a busbar with six conductor elements.

In a first exemplary embodiment of the invention, as is described in figs 1 to 11, the above-described "bracket solution" is used. In this case, the busbar holder described below serves to provide a busbar arrangement for an electrical switchgear assembly of double-front design. The switchgear assembly 1 has at least one busbar 2 which is held by a number of busbar holders 3 according to the invention. In this case, the busbar holder 3 according to figs 1 to 7 is suitable for holding different busbars. It is particularly suitable for holding a busbar 2 which has

a first (front) group 4 of conductor elements and a second (rear) group 5 of conductor elements, cf. figs 8 and 9. However, the busbar holder 3 is also suitable for holding a busbar which has a first (front) group 4 of conductor elements, a second (rear) group 5 of conductor elements and a third (central) group 6 of conductor elements, cf. figs 10 and 11. In this case, the (central) conductor elements 9 of the third group 6 of conductor elements are situated between the (front) conductor elements 7 of the first group 4 of conductor elements and the (rear) conductor elements 8 of the second group 5 of conductor elements, and protrude beyond the front and rear conductor elements 7, 8 transverse to the longitudinal direction 11 of the busbar. It is essential in all embodiments that the busbar holder 3 is arranged between the first (front) group 4 of conductor elements and the second (rear) group 5 of conductor elements.

The busbar holder 3 comprises two base body elements 12, three holding plates 13 and two securing brackets 14 for each phase. The busbar holder 3 itself comprises two identical base body elements 12 which are connected to one another in such a way that a symmetrical design of the busbar holder 3 is produced. To this end, the base body elements 12 bear against one another with their rear faces 15, while their front faces 16 form the outer faces 17 of the busbar holder 3. The busbar holder 3 is designed here in such a way that it carries three phases and one neutral conductor with identical spacing and identical insulation properties. Furthermore, an arrangement such as this is particularly favorable in terms of the EMC properties of the busbar arrangement.

The conductor elements 7, 8, which are each 10 mm thick, are held by means of a guide 18 on the outer face 17 of the busbar holder 3. In this case, the guide 18 is formed by a guide element 19 which is arranged firmly on the outer face 17 of the busbar holder 3, is preferably in the form of a web and is 10 mm wide, and secondly by a securing bracket 14 which can be

mounted on the outer face 17 of the busbar holder 3. The conductor elements 7, 8 are held in the guide 18 in an interlocking manner here.

The securing bracket 14 has three limbs 21, 22, 23 which point in one direction, run parallel to one another and are connected to one another by a connecting limb 24. The connecting limb 24 runs at right angles to the three limbs 21, 22, 23 and is arranged at one (rear) end of the limbs 21, 22, 23 in each case, so that a comb-like securing bracket 14 is produced.

In addition to the guide elements 19, a number of holding elements 25 are provided on the front faces 16 of the base body elements 12, these holding elements protruding from the front face. These holding elements serve to secure the busbar holder 3 on a mounting structure (frame) 26 of a switchgear cabinet or the like with the aid of holding plates 13. In this case, the holding plates 13 are in the form of angled elements which have a mounting face 28 with a first hole in order to form a screw-connection with one of the holding elements 25 at one end, and have a further second mounting face 29, which is offset in relation to the first mounting face 28 by 90° and has two further holes, in order to form a screw-connection with the mounting structure 26 at their opposite end. In this case, the holding plate 13 is formed in such a way that the busbar holder 3 with the busbar 2 is positioned at a secure distance from the mounting structure 26 of the switchgear cabinet or the like. It is particularly advantageous that the busbar holder 3 can be secured to the mounting structure 26 in a very simple manner with just two or three holding plates 13.

On account of the neutral conductor being carried along with the phases, only small leakage currents to the mounting structure 26 are produced if the N conductor becomes a PEN conductor.

In order to mount the two conductor elements 7 of the first group 4 of conductor elements, the mutually facing (inner) narrow faces 31 of said conductor elements are initially placed against both sides of the guide element 19 on the front face 16 of one base body element 12. In other words, the guide element 19 serves as a stop and a mounting aid. In a next step, a securing bracket 14 is in each case mounted above and below the two conductor elements 7, that is to say on their (outer) narrow faces 32 which point away from one another. In this case, the securing bracket 14 is mounted in such a way that said securing bracket 14 is pushed onto the busbar holder 3. In the mounted state, the inner faces 33 of the two outer limbs 21, 22 bear against the outer faces 17 of the busbar holder 3. In other words, the securing bracket 14 bears simultaneously against the two outer faces 17 of the busbar holder 3 in the mounted state. Said securing bracket therefore surrounds the busbar holder 3, so that conductor elements 7, 8 can be secured to both sides of the busbar holder 3.

Both the inner faces 33 of the two outer limbs 21, 22 and also the outer face 17 of the busbar holder 3 have mounting elements 35 in the form of grooves and, respectively, prongs or lugs which form a guide in the manner of a groove-and-tongue connection by engaging in one another. In this case, the mounting elements 35 are oriented transverse to the longitudinal direction 36 of the busbar holder, so that the securing bracket 14 is prevented from being displaced in the longitudinal direction 36 of the busbar holder in the mounted state. A plurality of mounting elements 35 which are arranged next to one another in the longitudinal direction 36 of the busbar holder are provided on the outer faces 17 of the busbar holder 3, so that the securing bracket 14 can be mounted on the busbar holder 3 in a manner which can be offset in terms of height. Therefore - by changing the receiving width of the guide 18 - conductor elements 7, 8 of different widths 37 can be mounted on the busbar holder 3.

PCT/EP2006/066450
2005P11115WOIN

- 14a -

Each limb 21, 22, 23 of the securing bracket 14 has a passage opening 44 for receiving a securing screw or pin 45 which is used to fix the securing bracket

14 to the two base body elements 12 of the busbar holder 3. To this end, the base body elements 12 also have a number of passage openings 46 which run in the groove-like mounting elements 35. These passage openings 46 are arranged such that they are offset in relation to one another, so that the cross section of the base body element 12 is weakened as little as possible. All passage openings 44, 46 are arranged in an aligned manner, so that the securing bracket 14 can be mounted with a single securing screw 45. In this case, the securing screw 45 passes fully through the securing bracket 14 and the busbar holder 3. In order to produce the screw-connection, either a thread is provided in at least one passage opening 44, 46 or else a separate nut is provided.

If the four guides 18 are produced for receiving the two conductor elements 7 of the front group 4 of conductor elements and the two conductor elements 8 of the rear group 5 of conductor elements and the four conductor elements 7, 8 are situated in these guides 18, the position of the conductor elements 7, 8 in the guides 18 is secured with the aid of a screw system. A fixing screw 47 or a fixing bolt which is provided with a nut serves this purpose. The fixing screw 47 or the fixing bolt runs in an opening 48 which is arranged in the center of the guide element 19 and interrupts the guide element 19, and engages in each case on the edges of the inner narrow faces 31 of the conductor elements 7, 8 of a group 4, 5 of conductor elements.

If the busbars 2 to be mounted are equipped with two groups 4, 5 of conductor elements, that is to say with four conductor elements 7, 8, nonconductive intermediate pieces 49 can be inserted between the central limbs 23 of the securing brackets 14 and the second spacer elements 41 which bound the receiving opening 38 on the opposite side, so that the busbar holder cannot be deformed by the screws 47, cf. fig. 9.

It is clear from the figure shown that the busbar holder 3 is arranged between the conductor elements 7 of a first (front) group 4 of conductor elements and the conductor elements 8 of a second (rear) group 5 of conductor elements. In this case, the total of four conductor elements 7, 8 are arranged in a rectangle, with the conductor elements of one group of conductor elements each being arranged aligned with one another and transverse to the longitudinal direction 11 of the busbar. On account of the arrangement in the intermediate space between the groups 4, 5 of conductor elements, the outer faces 51 of the conductor elements 7, 8 are free both at the front and at the rear. Connection on both sides, for example in order to produce a double-front arrangement, can therefore be realized without difficulty.

If busbars 2 with three groups 4, 5, 6 of conductor elements, that is to say with six conductor elements 7, 8, 9, are used, the two third (central) conductor elements 9 are arranged between the first conductor elements 7 and the second conductor elements 8. In this case, the central conductor elements 9 are likewise each arranged aligned with one another transverse to the longitudinal direction 11 of the busbar. Here, the central limb 23 of the securing bracket 14 serves as a spacer element which, in the mounted state, forms a stop for one of the conductor elements 9 of the third (central) group 6 of conductor elements. If the central conductor elements 9 are arranged offset in such a way that they protrude beyond the outer narrow faces 32 of the front and rear conductor elements 7, 8 transverse to the longitudinal direction 11 of the busbar, a greater current-carrying capacity is achieved. In this case, the central limbs 23 of the securing brackets 14, which limbs serve as spacer elements, are arranged opposite the two outer limbs 21, 22 in a manner offset in terms of height. In other words, the height 52 of the central limb 23 is lower than the height 53 of the outer limbs 21, 22, so that the difference in height between the upper face 54 and, respectively, the lower

face of the central limb 23 and the upper face 55 and, respectively, the lower face of the outer limbs 21, 22 in each case corresponds to the offset of the central conductor element 9 in relation to the outer conductor elements 7, 8. In this case, the central limb 23 is arranged in the middle of the securing bracket 14,

so that the securing screw 45 also runs through the center of the securing bracket 14.

When mounting the six conductor elements 7, 8, 9 on the busbar holder 3, the four outer conductor elements 7, 8 are initially placed on the guide element 19 again. The two securing brackets 14 are then pushed onto the busbar holder 3 above and below the conductor elements 7, 8, with the central limbs 23 penetrating the receiving openings 38 and there holding the two central conductor elements 9 in their position which is offset in terms of height in relation to the outer conductor elements 7, 8. Subsequently, the securing brackets 14 are screw-connected and the conductor elements 7, 8, 9 are again fixed to the guide element 19 using a fixing screw 47. In the example shown, very wide conductor elements 7, 8, 9 are used, so that the securing brackets 14 have to be fitted at the outermost mounting positions. In this case, the central limbs 23 of the securing brackets 14 bear against the spacer elements 39, 41' of the base body elements 12.

In a second exemplary embodiment of the invention, as is described in figs 12 to 19, the above-described "screw solution" is used, in which the conductor elements 7, 8, 9 are connected directly to the busbar holder 3. In this case, the intended use for the busbar holder 3 described below is the same as the intended use for the busbar holder 3 described above. The busbar holder 3 according to figs 12 and 13 is particularly suitable for holding busbars 2 with six conductor elements 7, 8, 9, whereas the busbar holder 3 according to figs 14 and 15 is particularly suitable for holding busbars 2 with four conductor elements 7, 8. It is again essential in all embodiments that the busbar holder 3 is arranged between the first (front) group 4 of conductor elements and the second (rear) group 5 of conductor elements.

The busbar holder 3 again comprises two base body elements 12 - as described above - which are mounted so that their rear faces 15 bear against one another. In this case, the base body elements 12 have securing openings 57 for producing a direct screw-connection to the conductor elements 7, 8, 9 of the busbar 2. The conductor elements 7, 8, 9 bear against the web-like guide elements 19 which are again provided on the outer faces 17 of the busbar holder 3, and are connected to the busbar holder 3 so as to form a screw-connection. The force fit is produced here by the screw-on pressure. Since the conductor elements 7, 8 are secured directly to the base body elements 12, the guide elements 19 do not have an opening in these cases and are therefore not interrupted by this opening either.

In a first embodiment, the rear faces 15 of the base body elements 12 are again, as described above, provided with spacer elements 39, 41, 41' which, in the mounted state, form continuous receiving openings 38 in the busbar holder 3. If busbars 2 with three groups 4, 5, 6 of conductor elements, that is to say with six conductor elements 7, 8, 9, are used, the narrow faces 31 of the front and rear conductor elements 7, 8 - as described above - are placed against the web-like guide elements 19 which are provided on the front faces 17 of the busbar holder 3, whereas the central conductor elements 9 are inserted into the receiving opening 38 between the base body elements 12. The conductor elements 7, 8, 9 are then screw-connected using securing screws or securing bolts 56. The spacer elements 39, 41, 41' which form the receiving opening 38 equally serve as a stop for the third (central) conductor elements 9 and thus equally produce the required offset in height.

Holding plates 13, which are screwed to protruding holding elements 25 on the outer faces 17 of the busbar holder 3 again

serve to mount the busbar holder 3 on a mounting structure 26 of a switchgear cabinet 1 or the like.

In a second embodiment, the rear faces 15 of the base body elements 12' are flat and do not have any spacer elements or the like. In other words, the rear faces 15 bear against one another over a large area in the mounted state. This type of base body element 12' is used particularly when busbars 2 with only four conductor elements 7, 8 are to be mounted. Specifically, a receiving opening between the two base body elements 12 is then not required.

The securing openings 58, 59 in the base body elements 12, which openings are required to produce the screw-connection between conducting elements 7, 8 and the busbar 3, are arranged in the longitudinal direction 36 of the busbar holder in a manner offset in relation to one another. This ensures that conductor elements 7, 8 of different widths 37 can be mounted on the same busbar holder 3. In the arrangement shown in fig. 15, the conductor elements 7, 8 are comparatively narrow, so that the inner receiving openings 59 with a smaller diameter can be used. In order to mount wider conductor elements 7, 8, the outer receiving openings 58 have to be used, these receiving openings also having a larger diameter. The receiving openings are provided in such a way that the inner receiving openings 59 can be used for conductor element widths of 20 and 30 mm, and the outer receiving openings 58 can be used for conductor element widths of 40 and 50 mm. This double occupation of the receiving openings 58, 59 on the busbar holder 3 requires a particular arrangement of the receiving openings (not shown) in the conductor elements 7, 8: in conductor elements with a width of 20 or 40 mm, the receiving openings are in each case provided in the center of the conductor elements 7, 8, whereas in conductor elements 7, 8 with a width of 30 or 50 mm, the receiving openings are arranged off-center.

As examples of the universal applicability of the busbar holder 3 according to the invention, figs 16 to 19 depict various mounting arrangements for a busbar holder 3 using a "screw solution". For example, fig. 16 shows a side view of a busbar holder 3 for a busbar 2 with two 20 mm-wide conductor elements 7. In other words, the busbar holder 3 according to the invention can also be used to mount a busbar 2 with only one group 4 of conductor elements. In this case, the two conductor elements 7 are mounted on one side of the busbar holder 3, while the opposite second outer face 17 of the busbar holder 3 remains free. Fig. 17 shows a busbar holder 3 for a busbar 2 with four 30 mm-wide conductor elements 7, 8, as is also depicted in fig. 15. Fig. 18 shows a busbar holder 3 for a busbar 2 with four 50 mm-wide conductor elements 7, 8. Figs 16, 17 and 18 show a busbar holder 3 comprising base body elements 12' with flat rear faces 15. Fig. 19 shows a busbar holder 3 comprising base body elements 12 with profiled rear faces 15, as is depicted in fig. 13, for holding a busbar 2 with six 50 mm-wide conductor elements 7, 8, 9.

The dimension data indicates the 10 mm pattern used here. However, it goes without saying that other dimensions are also possible. The base bodies 12, 12' of the busbar holder 3 are produced from an insulating plastics material which is heat-resistant over the long term and also possesses the required strength, in particular with regard to the forces which occur in the event of a short circuit. The plastics material used is preferably a thermosetting plastic.

List of reference symbols

- 1 Switchgear assembly
- 2 Busbar
- 3 Busbar holder
- 4 First group of conductor elements
- 5 Second group of conductor elements
- 6 Third group of conductor elements
- 7 First conductor element
- 8 Second conductor element
- 9 Third conductor element
- 10 (free)
- 11 Longitudinal direction of the busbar
- 12 Round body element
- 13 Holding plate
- 14 Securing bracket
- 15 Rear face of the base body element
- 16 Front face of the base body element
- 17 Outer face of the busbar holder
- 18 Guide
- 19 Guide element
- 20 (free)
- 21 First outer limb
- 22 Second outer limb
- 23 Central limb
- 24 Connecting limb
- 25 Holding element
- 26 Mounting structure
- 27 (free)
- 28 First mounting face
- 29 Second mounting face
- 30 (free)
- 31 Inner narrow face
- 32 Outer narrow face
- 33 Inner face of the outer limb
- 34 (free)

PCT/EP2006/066450
2005P11115WOIN

- 21a -

- 35 Mounting element
- 36 Longitudinal direction of the busbar holder

- 37 Width of the conductor element (guide width)
- 38 Receiving opening
- 39 Spacer element
- 40 (free)
- 41 Spacer element
- 42 Outer face of the central limb
- 43 Side face of the busbar holder
- 44 Passage opening
- 45 Securing screw
- 46 Passage opening
- 47 Fixing screw
- 48 Opening in the guide element
- 49 Intermediate piece
- 50 (free)
- 51 Outer face of the conductor element
- 52 Height of the central limb
- 53 Height of the outer limb
- 54 Upper face of the central limb
- 55 Upper face of the outer limb
- 56 Fixing screw
- 57 Securing opening in the base body
- 58 Outer securing opening in the base body
- 59 Inner securing opening in the base body

Patent claims

1. A busbar arrangement for an electrical switchgear assembly (1) of double-front design, having a busbar (2) which is held by at least one busbar holder (3), with the busbar (2) having at least one first group (4) of conductor elements comprising at least two first conductor elements (7) and a second group (5) of conductor elements comprising at least two second conductor elements (8),
characterized in that the busbar holder (3) is arranged between the conductor elements (7) of the first group (4) of conductor elements and the conductor elements (8) of the second group (5) of conductor elements.
2. The busbar arrangement as claimed in claim 1,
characterized in that the busbar holder (3) has two base body elements (12).
3. The busbar arrangement as claimed in claim 2,
characterized in that the base body elements (12) are identical.
4. The busbar arrangement as claimed in claim 2 or 3,
characterized in that the base body elements (12) are connected to one another in such a way that a symmetrical design of the busbar holder (3) is produced.
5. The busbar arrangement as claimed in one of claims 1 to 4,
characterized in that the busbar (2) has a third group (6) of conductor elements which is arranged between the first group (4) of conductor elements and the second group (5) of conductor elements, and whose conductor elements (9) protrude beyond the conductor elements (7, 8) of the first and second groups (4, 5) of conductor elements transverse to the longitudinal direction (11) of the busbar.

6. The busbar arrangement as claimed in claim 5, characterized in that the busbar holder (3) has at least one receiving opening (38) for receiving at least one conductor element (9) of the third group (6) of conductor elements or a preferably conductive filler piece (49).

7. The busbar arrangement as claimed in one of claims 1 to 6, characterized in that at least one conductor element (7, 8) of the first or second group (4, 5) of conductor elements is situated in a guide (18) on the outer face (17) of the busbar holder (3).

8. The busbar arrangement as claimed in claim 7, characterized in that the guide (18) is formed firstly by a guide element (19) which is arranged firmly on the outer face (17) of the busbar holder (3) and secondly by a securing bracket (14) which can be mounted on the outer face (17) of the busbar holder (3).

9. The busbar arrangement as claimed in claim 8, characterized in that the securing bracket (14) bears simultaneously against the two outer faces (17) of the busbar holder (3).

10. The busbar arrangement as claimed in one of claims 7 to 9, characterized in that at least one conductor element (7, 8) of a group (4, 5) of conductor elements is secured in the guide (18) by means of a screw-connection.

11. The busbar arrangement as claimed in one of claims 7 to 10, characterized in that the receiving width (37) of the guide (18) can be varied in order to secure conductor elements (7, 8, 9) of different sizes.

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

- the busbar holder (3) has a number of first mounting elements (35) which are arranged next to one another in the longitudinal direction (11) of the busbar holder on at least one area of contact (15, 16) with the securing bracket (14), and
- the securing bracket (14) has second mounting elements (35) on at least one of its areas of contact (33, 42) with the busbar holder (3), said second mounting elements forming a guide with the first mounting elements (35) in the mounted state.

13. The busbar arrangement as claimed in one of claims 7 to 12, characterized in that the securing bracket (14) has a spacer element (23) which, in the mounted state, is situated in the receiving opening (38) of the busbar holder (3) and forms a stop for a conductor element (9) of the third group (6) of conductor elements.

14. The busbar arrangement as claimed in one of claims 1 to 6, characterized in that

- the busbar holder (3) and at least one conductor element (7, 8) of a group (4, 5) of conductor elements each have at least one securing opening (57) for receiving a securing means (56), and
- the conductor element (7, 8) bears against the outer face (17) of the busbar holder (3) and is connected to the busbar holder (3) in a force-fitting manner on account of screw-on pressure so as to form a screw-connection.

15. The busbar arrangement as claimed in claim 14, characterized in that the busbar holder (3) has a number of different securing openings (58, 59) for securing conductor elements (7, 8, 9) of different sizes.

16. The busbar arrangement as claimed in claim 15,

characterized in that the position and/or size of the securing openings (58, 59) differ.

17. The busbar arrangement as claimed in one of claims 14 to 16,

characterized in that a receiving opening (38) of the busbar holder (3) is bounded by a spacer element (39, 41, 41') which forms a stop for a conductor element (9) of the third group (6) of conductor elements.