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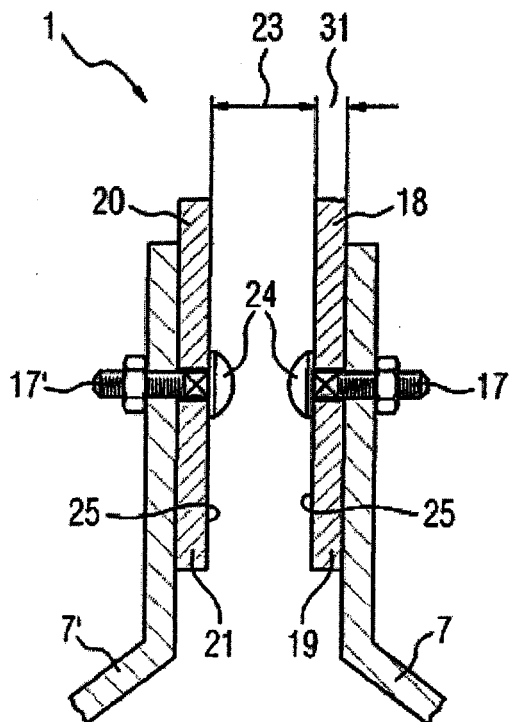
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(54) Title: BUSBAR SYSTEM FOR A DOUBLE-FRONT ELECTRICAL SWITCHGEAR

(54) Bezeichnung: SAMMELSCHIENENANORDNUNG FÜR EINE ELEKTRISCHE SCHALTANLAGE IN DOPPELFONT-
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(57) Abstract: The invention relates to a busbar system for a double-front electrical switchgear. The aim of the invention is to provide a solution for a double-front system wherein the connections from the front and the rear do not collide and which at the same time allows an improved current distribution in the subconductors per phase. For this purpose, a busbar (8) comprising at least two first subconductors (18, 19) and at least two second subconductors (20, 21) is used, the distance (23) between the first subconductors (18, 19) and the second subconductors (20, 21) corresponding to at least twice the thickness (31) of a subconductor.

(57) Zusammenfassung: Die Erfindung betrifft eine Sammelschielenanordnung für eine elektrische Schaltanlage in Doppelfrontbauweise. Um eine Lösung für eine Doppelfrontanordnung zu finden, bei der die Anschlüsse von vorn und hinten nicht kollidieren und zugleich eine verbesserte Stromverteilung in den Teilleitern je Phase erreicht wird, wird vorgeschlagen, eine Sammelschiene (8) zu verwenden, die wenigstens zwei erste Teilleiter (18, 19) und wenigstens zwei zweite Teilleiter (20, 21) aufweist, wobei der Abstand (23) zwischen den ersten Teilleitern (18, 19) und den zweiten Teilleitern (20, 21) mindestens der zwelffachen Dicke (31) eines Teilleiters entspricht.

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Description

BUSBAR SYSTEM FOR A DOUBLE-FRONT ELECTRICAL SWITCHGEAR

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

For some time, low-voltage 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. The field rails are connected to the common busbar, which is situated in the middle, from the front and from the rear here.

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 eddy current losses. In the busbar arrangements 100 with four conductor elements 101 arranged in a rectangle and a distance 102 between the conductor elements of approximately 10 mm which have been known to date, the different connection possibilities from the front and rear have always had to be taken into account in order to prevent the connection bolts 104 from colliding when field rails 103 were connected to the busbar, cf. fig. 6. A complex system was necessary for the simultaneous connection of devices to the busbar from the front and rear.

One object of the present invention is to find a solution for a double-front arrangement in which the connections from the front and rear do not collide and improved current distribution

is achieved in the conductor elements for each phase at the same time.

This object is achieved by a busbar arrangement as claimed in claim 1. This claim makes provision for the busbar, which is held by at least one busbar holder, to have at least two first (front) conductor elements and at least two second (rear) conductor elements, with the distance between the first conductor elements and the second conductor elements corresponding to at least twice the thickness of one conductor element. The distance is therefore greater than or equal to twice the thickness of one conductor element. In this case, the first and second conductor elements of the busbar are each preferably arranged transverse to the longitudinal direction of the busbar and in a manner aligned with one another, and have the same thickness (preferably 10 mm here).

One basic idea of the invention involves increasing the distance between the front and rear conductor elements. Therefore, the increased intermediate space between the front and rear conductor elements can be used for connections to the front and to the rear, without resulting in collisions between the connecting elements (preferably connection bolts). It is therefore extremely simple to simultaneously connect devices to the busbar from the front and rear.

Furthermore, the greater distance between the front and rear conductor elements (preferably at least 20 mm here) compared to conventional systems also improves current distribution in the conductor elements for each phase on account of the skin effect and the proximity effect. In other words, current distribution to the conductor elements in one phase is very homogeneous and the current which can be transmitted for each cross-sectional unit is comparatively high too.

The described busbar arrangement with four conductor elements which are widely spaced apart from one another can be used particularly in the case of low rated currents for the busbar system. The material requirement (in particular for copper) can therefore be kept low, depending on the level of current required in each case.

Advantageous refinements of the invention are specified in the subclaims.

It has proven particularly advantageous, especially in the case of relatively high rated currents for the busbar system, that the busbar has at least two third (central) conductor elements between the first conductor elements and the second conductor elements. In this case, a distance is preferably provided between the first conductor elements and the second conductor elements which corresponds to at least three times the thickness of one conductor element (preferably at least 30 mm here). The distance is therefore greater than or equal to three times the thickness of one conductor element.

As a result, current distribution is improved further. Overall, the more uniform distribution of current in a conductor element arrangement of this type means 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 double-front arrangements. The cross sections for each phase can be designed for rated currents of above 3500 A.

The simple connection system is also retained in the case of three pairs of conductor elements with the same connection planes. Specifically, the bolt heads preferably bear against the mutually facing inner faces of the front and rear conductor elements in this case too. Therefore, the bolt heads of the connection bolts for the connections from the front are arranged between the front and the central conductor elements,

whereas the bolt heads of the connection bolts for the connections from the rear are arranged between the central and the rear conductor elements.

The busbar arrangement according to the invention is preferably formed in such a way that the first connection bolts for producing a connection between a field rail and the front conductor elements can be arranged, such that they can be mounted, in any desired manner in relation to the second connection bolts for producing a connection between a field rail and the rear conductor elements. For example, they can be arranged such that they are not aligned or else such that they are aligned with one another. In other words, the increased distance between the front and rear conductor elements enables the field rails to be mounted in such a way that the connection bolts can be mounted level and offset in relation to one another or else aligned. Since a single connection bolt - as known from the prior art - is no longer used in order to connect the field rails to the busbar, but instead two connection bolts which are independent of one another are used according to the invention, the front connection is decoupled from the rear connection.

The connection bolts used may be cup square bolts according to DIN 603. However, it has proven particularly advantageous for quick and reliable mounting for the connection bolts used to be T-head bolts with a square neck according to DIN 186. Compared to cup square bolts, said T-head bolts with a square neck provide the advantage that the bolt is inserted from the front or rear into the free space between the conductor elements of an arrangement which has already been fully mounted, and can be turned through 90° in the free space. In other words, the bolt does not rotate when the nut is tightened since the square neck is located between the conductor elements.

If the conductor elements of the busbar are connected to one another in the vicinity of the field rail connections by means of preferably screwed-in intermediate pieces, as is provided in a further preferred embodiment of the invention, current compensation can be produced between front or rear conductor elements and the central conductor elements in a simple manner, without resulting in a collision between the front and rear connections. In this case, the intermediate pieces are advantageously likewise produced from rail material (in particular copper).

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 switchgear cabinet of double-front design,

fig. 2 shows (a perspective view of) a busbar with two pairs of conductor elements,

fig. 3 shows (a perspective view of) a busbar with three pairs of conductor elements,

fig. 4 shows a busbar with two pairs of conductor elements (section IV-IV in fig. 2),

fig. 5 shows a busbar with three pairs of conductor elements (section V-V in fig. 3), and

fig. 6 shows (a section through) a busbar with two pairs of conductor elements according to the prior art.

Fig. 1 shows a busbar arrangement 1 for a low-voltage switchgear assembly, that is to say an assembly in which electrical energy is distributed. The switchgear assembly

comprises a plurality of switchgear cabinets 2. It is designed as a double-front arrangement. This means that the assembly has an operator control panel 5, 6 both on the front face 3 (at the front) and on the rear face 4 (at the rear). The double-front arrangement also has a common busbar system (N, L1, L2, L3). In this case, the field rails 7 are connected to the common, centrally positioned busbar 8 (main busbar) from the front and from the rear. Switchgear devices 9, 10 are connected to the field rails, the operator control panels 5, 6 of said switchgear devices each protruding from the front face 3 or rear face 4 of the switchgear cabinet 2 for operator control purposes. Further connection rails 11 pass from the switchgear devices 9, 10 to further devices (not illustrated) in the switchgear cabinet 2.

In this case, a busbar system is understood to be a number of rail-like current conductors which are present in a number and arrangement in which they are required to transport power in single-phase or multiphase networks. In other words, the present invention is not restricted only to busbars in the actual sense of the word. In fact, the invention can be used in any type of conductor bar.

Fig. 2 shows a single busbar 8 of the busbar arrangement. For reasons of clarity, the busbar holder has not been illustrated. Said busbar holder is preferably positioned on at least one of the free ends of the busbar 8. The busbar L1 is illustrated in the example. This busbar 8 has two copper conductor bars 14, 15 which each, in the center, have an elongate hole 16 for mounting the field rails 7, 7' by means of connection bolts 17, 17'. This produces a total of two pairs of conductor elements, as illustrated in fig. 4. In this case, the first pair of conductor elements comprises the conductor elements 18, 19 which are formed above and below the elongate hole 16 in the first conductor bar 14, and the second pair of conductor elements comprises the conductor elements 20, 21 which are

formed above and below the elongate hole 16 in the second conductor bar 15. In this case, the front conductor elements 18, 19 and the rear conductor elements 20, 21 of the busbar 8 each run transverse to the longitudinal direction 22 of the busbar and in a manner aligned with one another. The distance 23 between the front conductor elements 18, 19 and the rear conductor elements 20, 21 corresponds to three times the thickness of one conductor element 18, 19, 20, 21 here. In the present case, the thickness 31 of one conductor element is 10 mm (cf. fig. 4) and the distance 23 between the front conductor elements 18, 19 and the rear conductor elements 20, 21 is 30 mm.

The field rails 7, 7' are connected to the front and rear conductor elements 18, 19, 20, 21 by connection bolts 17, 17'. The connection bolts 17, 17' used are cup square bolts according to DIN 603. In this case, the connection bolts 17, 17' are situated between the two front conductor elements 18, 19 and, respectively, the two rear conductor elements 20, 21 in the corresponding elongate holes 16 and, with their bolt heads 24, bear against the mutually facing inner faces 25 of the front and rear conductor elements 18, 19, 20, 21. The front connection bolts 17 can be mounted in a manner offset in relation to the rear connection bolts 17' in this case.

Fig. 3 shows a further embodiment of a single busbar of the busbar arrangement. The busbar L1 is again illustrated in the example. This busbar has three copper conductor bars 14, 15, 26. These conductor bars in turn each have an elongate hole 16 for mounting the field rails 7, 7' by means of connection bolts 17, 17'. A total of three pairs of conductor elements are thus produced. The front and rear pairs of conductor elements are in the form illustrated in fig. 2. In this case, the third, central pair of conductor elements comprises the conductor elements 29, 30 which are formed above and below the elongate hole 16 in the third, central conductor bar 28. The front,

central and rear conductor elements 18, 19, 20, 21, 29, 30 of the busbar each run transverse to the longitudinal direction 22 of the busbar and in a manner aligned with one another, as illustrated in fig. 5. The distance 23 between the front conductor elements 18, 19 and the rear conductor elements 20, 21 in this case corresponds to three times the thickness of one conductor element, here 30 mm, with the central conductor bar 28 being arranged precisely in the center between the outer conductor bars 14, 15.

The field rails 7, 7' are connected as described above.

The front conductor elements and the rear conductor elements (in the case of two pairs of conductor elements) and, respectively, the front conductor elements and the central conductor elements, and the central conductor elements and the rear conductor elements (in the case of three pairs of conductor elements) are preferably connected to one another in the vicinity of the field rail connections by means of screwed-in copper intermediate pieces (not depicted).

In this connection, it should be pointed out that the distances 23 between the individual pairs of conductor elements in figs 2 and 3 have not been drawn to scale, but instead are illustrated on a greatly enlarged scale for reasons of clarity.

List of reference symbols

- 1 Busbar arrangement
 - 2 Switchgear cabinet
 - 3 Front face
 - 4 Rear face
 - 5 Operator control panel at the front
 - 6 Operator control panel at the rear
 - 7 Field rail
 - 8 Busbar
 - 9 Switchgear device at the front
 - 10 Switchgear device at the rear
 - 11 Connection bar
 - 12 (free)
 - 13 (free)
 - 14 Conductor bar
 - 15 Conductor bar
 - 16 Elongate hole
 - 17 Connection bolt
 - 18 Front conductor element
 - 19 Front conductor element
 - 20 Rear conductor element
 - 21 Rear conductor element
 - 22 Longitudinal direction of the busbar
 - 23 Distance
 - 24 Bolt head
 - 25 Inner face
 - 26 (free)
 - 27 (free)
 - 28 Conductor bar
 - 29 Central conductor element
 - 30 Central conductor element
 - 31 Conductor element thickness
-
- 100 Busbar arrangement
 - 101 Conductor element

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- 102 Distance
- 103 Field rail
- 104 Connection bolt

Patent claims

1. A busbar arrangement (1) for an electrical switchgear assembly of double-front design, in particular a low-voltage switchgear assembly, having at least one busbar (8) which is held by at least one busbar holder, characterized in that the busbar (8) has at least two first conductor elements (18, 19) and at least two second conductor elements (20, 21), with the distance (23) between the first conductor elements (18, 19) and the second conductor elements (20, 21) corresponding to at least twice the thickness (31) of one conductor element.

2. The busbar arrangement (1) as claimed in claim 1, characterized in that the busbar (8) has at least two third conductor elements (29, 30) between the first conductor elements (18, 19) and the second conductor elements (20, 21).

3. The busbar arrangement (1) as claimed in claim 1 or 2, characterized in that a field rail (7) is fitted to the first and/or second conductor elements (18, 19, 20, 21) of the busbar (8) using a number of connection bolts (17), with the bolt heads (24) being arranged on the mutually facing inner faces (25) of these conductor elements (18, 19, 20, 21).

4. The busbar arrangement (1) as claimed in one of claims 1 to 3, characterized in that the connection between a field rail (7) and the first conductor elements (18, 19) is produced by a number of first connection bolts (17), and the connection between a field rail (7') and the second conductor elements (20, 21) is produced by a number of second connection bolts (17').

5. The busbar arrangement (1) as claimed in claim 3 or 4, characterized in that the connection bolts (17, 17') are T-head bolts with a square neck.

6. The busbar arrangement (1) as claimed in one of claims 1 to 5,

characterized

in that the conductor elements (18, 19, 20, 21) of the busbar (8) can be connected to one another in the vicinity of the field rail connections by means of intermediate pieces for current compensation between the conductor elements (18, 19, 20, 21).