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(54) Electrical coupling device

(57) The present invention relates to an electrical coupling device. The electrical coupling device (1) allows coupling between different sets of busbars (2, 3) that are encapsulated or insulated in their corresponding modules (4, 5), such that said coupling is carried out when they are live, i.e., without putting a line connection switchboard comprising the set of busbars (2) out of service. The device (1) allows performing quick and safe electrical coupling, maintaining the protection rating of IP2X at all times.

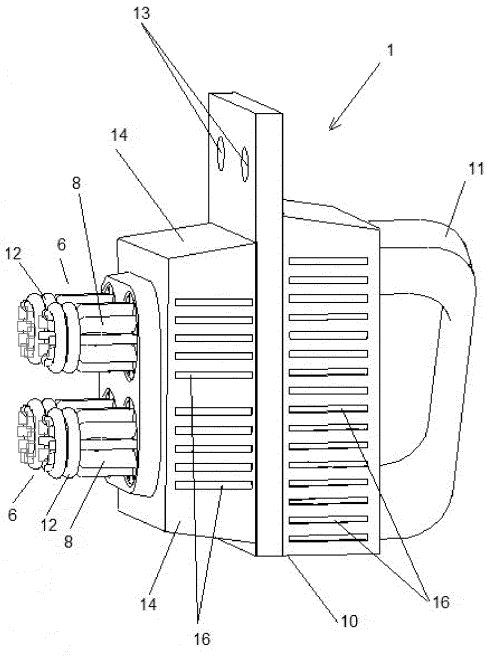

Fig. 2

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Description

Object of the Invention

[0001] The present invention relates to a device for the electrical coupling between sets of busbars of electrical equipment. The objective of the coupling device is to allow quick and safe electrical coupling between pieces of electrical equipment when they are live, preventing access to active live parts.

Background of the Invention

[0002] Electrical low-voltage power distribution equipment, also referred to as low-voltage switchboards, comprise a metal or insulating enclosure inside which different electrical components, such as the set of line connection busbars of the switchboard, the set of distribution busbars, the outlets with a fuse-holder base, the operating means responsible for insulating the low-voltage switchboard from the power supply and/or grounding the set of distribution busbars, and the auxiliary and measuring circuit outlet, are installed.

[0003] These low-voltage switchboards can be expanded. The need for expansion can be due to an increase in the consumers connected to one and the same switchboard or due to an increase in energy demand. In this sense, there are usually two low-voltage switchboards in an installation, the line connection switchboard and the expansion switchboard. When there is a need to expand the switchboard, the expansion switchboard, with its corresponding set of busbars and outlets with a fuse-holder base, is coupled to the line connection switchboard such that the low-voltage switchboard will have more outlets for supplying power to new consumers or for supplying power for a higher energy demand.

[0004] This expansion of the low-voltage switchboard is carried out by first interrupting the service of the switchboard itself (for the sake of safety,) i.e., putting said low-voltage switchboard out of service, since it is necessary to access parts of the switchboard which are live when said switchboard is in service, such as the set of busbars of the line connection switchboard for connecting said set of busbars and the busbars of the expansion switchboard, for example. In order to put the low-voltage switchboard out of service, it is necessary to perform several operations in the installation where said low-voltage switchboard is located. Usually, when the installation has only one low-voltage switchboard, the voltage of the medium/low-voltage transformer must first be cut off, then the switchboard is sectioned both upstream and downstream of the switchboard, thus cutting off the power supply of the switchboard, and next the set of busbars must be grounded, part of the switchboard dismantled and the set of busbars of the latter coupled with the busbars of the expansion switchboard by means of flat bars and screws. The installation is finally powered up again once the expansion is performed.

[0005] This interruption of service for expanding the low-voltage switchboard involves the drawback of cutting off power to consumers while the expansion work lasts, which means that service quality drops, further translating into an installation that is likely to experience faults due to a possible poor connection of the expansion switchboard since the connections are screwed together by means of flat bars, into modifications in which performing expansion work involves a long interruption of consumer service over time, and into modifications or work involving a large number of operations. However, the expansion of the low-voltage switchboard especially involves the intervention of operators who may run the risk of accidental electrocution since some vital power supplies of the installation are still live during the expansion.

Description of the Invention

[0006] The electrical coupling device object of the invention seeks to solve each and every one of the aforementioned problems. The coupling device allows electrically coupling at least a first set of busbars encapsulated or insulated in at least a first module made of insulating material, belonging to a line connection switchboard, with at least a second set of busbars encapsulated or insulated in at least a second module also made of insulating material and belonging to an expansion switchboard. Encapsulated set of busbars is understood as a set of busbars with insulating material injected over said set of busbars, whereas insulated set of busbars is understood as a set of busbars comprising an insulating outer enclosure that is removable from said set of busbars.

[0007] The electrical coupling device comprises at least one connector comprising at least one conductive part for the electrical plug-in coupling of at least one electrical connection point encapsulated or insulated in the first module with another electrical connection point encapsulated or insulated in the second module, where each electrical connection point comprises at least one conductive terminal to which the conductive part can be plugged in.

[0008] The device allows performing the electrical coupling when the line connection switchboard is live, i.e., without putting the line connection switchboard out of service or cutting off the power supply to consumers during the operation of expanding said line connection switchboard.

[0009] Said electrical connection points, both of the first module and of the second module, can be insulated from the bare sets of busbars that may be arranged by means of an insulating barrier.

[0010] The connector of the coupling device comprises at least one conductive part, such that the electrical connection of said conductive part with the first and/or second electrical connection point encapsulated or insulated in their respective module is of the plug-in type. Said at least one conductive part is coupled to at least one con-

ductive terminal comprised by each of said electrical connection points, the coupling device comprising at least one spring keeping the conductive part attached to enable plugging it in to the conductive terminal, therefore, the spring pushes said conductive part against the conductive terminal and assures suitable electrical contact between them.

[0011] Since it is a device that allows electrical plug-in coupling, the need to disassemble part of the line connection switchboard and couple the set of busbars of the switchboard with the busbars of the expansion switchboard by means of flat bars and screws is prevented, thus preventing faults due to a poor connection of the expansion switchboard.

[0012] The electrical coupling device is a mobile element which the operator can connect to and disconnect from the electrical connection points encapsulated or insulated in the modules of the line connection switchboard and expansion switchboard. The coupling device object of the invention can be a single multiphase device used for the electrical coupling of all phases and the neutral comprised in the sets of busbars or can consist of a single-phase device, i.e., in this case, one coupling device would be used for each phase and another device would be used for the neutral.

[0013] The coupling device comprises an insulating enclosure with at least one handgrip which allows handling the device when expanding the line connection switchboard when it is live. Furthermore, the enclosure comprises a portion configured for being fitted in a cavity formed by the attachment of the insulating modules which encapsulate or insulate the sets of busbars, said portion of the enclosure guiding at least one connector of the coupling device towards at least one conductive terminal of at least one electrical connection point, and thus concealing all the live parts and assuring inaccessibility to said active live parts, maintaining the protection rating of IP2X at all times and preventing electrocution accidents and/or an incorrect connection. A passageway is also formed in the attachment of the insulating modules through which cooling of the electrical coupling between at least one electrical connection point and at least one connector is allowed.

[0014] Finally, the insulating enclosure comprises at least one mechanical connection point for fixing the electrical coupling device with at least one insulating module in which the set of busbars is encapsulated.

Description of the Drawings

[0015] To complement the description that is being made and for the purpose of aiding to better understand the features of the invention according to a preferred practical embodiment thereof, a set of drawings is attached as an integral part of said description in which the following has been depicted with an illustrative and non-limiting character:

Figure 1 shows a front view of the module of the line connection switchboard and of the module of the expansion switchboard coupled by means of several electrical coupling devices.

Figure 2 shows a perspective view of the electrical coupling device corresponding to a phase.

Figure 3 shows a perspective view of the modules and the conductive terminals to which the coupling device is plug-in coupled.

Preferred Embodiment of the Invention

[0016] The coupling device (1) shown in Figures 1-2 allows the electrical coupling between a first set of busbars (2) encapsulated or insulated in at least a first module (4) of a line connection switchboard and a second set of busbars (3) encapsulated or insulated in at least a second module (5) of an expansion switchboard.

[0017] The coupling of module (4) with module (5) allows expanding the line connection switchboard, such that it will have more outlets for supplying power to new consumers or for supplying power for a higher energy demand. The electrical coupling device (1) enables performing the expansion operation with line connection switchboard when it is live, without putting it out of service. To that end, the coupling device (1) comprises at least one connector (6) provided with at least one conductive part (8) which is electrically coupled by plugging it in to at least one conductive terminal (9, 9') of at least one electrical connection point (7, 7') encapsulated or insulated in the modules (4, 5). As shown in Figures 1-2, the electrical connection point (7) comprising a conductive terminal (9) is encapsulated or insulated in the module (4) incorporating the set of busbars (2) encapsulated or insulated therein. In turn, the electrical connection point (7') comprising a conductive terminal (9') is encapsulated or insulated in the module (5) incorporating the set of busbars (3) encapsulated or insulated therein. The conductive parts (8) are coupled to the terminals (9, 9') such that the electrical coupling carried out by means of the device (1) is of the plug-in type, which thus allows an easily connected/disconnected quick coupling. Furthermore, the coupling device (1) comprises at least one spring (12) for pushing said conductive parts (8) against the conductive terminal (9, 9'), thus assuring suitable electrical contact between them.

[0018] The coupling device (1) also comprises an insulating enclosure (10), as shown in Figure 2. This enclosure (10) comprises a portion (14) configured such that by electrically coupling the conductive parts (8) to the conductive terminals (9, 9'), said portion (14) fits in a cavity (15) formed by the coupling of module (4) with module (5). All the active live parts are therefore concealed and insulated, even during the connect/disconnect operation, assuring inaccessibility to said active live parts and preventing the contamination of the electrical connection points (7, 7') and of the electrical coupling in general. Furthermore, said portion (14) of the enclosure

(10) enables guiding at least one connector (6) of the coupling device (1) towards at least one conductive terminal (9, 9') of at least one electrical connection point (7, 7'). The coupling device (1) assures a safe electrical coupling that is resistant to possible short circuit currents.

[0019] The enclosure (10) comprises at least one handgrip (11) for handling the device (1) when performing the electrical coupling between the sets of busbars (2, 3). The enclosure (10) also comprises several slots (16) that allow the cooling of the electrical coupling between the conductive parts (8) and the conductive terminals (9, 9'). Furthermore, a passageway (17) is formed in the coupling between the modules (4) and (5) through which the cooling of said electrical coupling is allowed. Finally, the enclosure (10) comprises at least one mechanical connection point (13) for fixing the device (1) with at least one module (4, 5).

[0020] Finally, the possibility of the coupling device (1) being able to be encapsulated in an insulating material, such as for example in epoxy resin or in polymer concrete, instead of comprising an enclosure is contemplated.

Claims

1. Electrical coupling device (1) between at least a first set of busbars (2) encapsulated or insulated in at least a first module (4) and at least a second set of busbars (3) encapsulated or insulated in at least a second module (5), **characterized in that** the device (1) comprises at least one connector (6) comprising at least one conductive part (8) for the electrical plug-in coupling of at least one electrical connection point (7) encapsulated or insulated in the first module (4) to another electrical connection point (7') encapsulated or insulated in the second module (5), where each electrical connection point (7, 7') comprises at least one conductive terminal (9, 9') to which the conductive part (8) can be plugged in.

2. Coupling device (1) according to claim 1, **characterized in that** it comprises at least one spring (12) keeping each conductive part (8) attached to enable plugging it in to the conductive terminal (9, 9').

3. Coupling device (1) according to any of the preceding claims, **characterized in that** it comprises an insulating enclosure (10) preventing access to live parts.

4. Coupling device (1) according to claim 3, **characterized in that** the enclosure (10) comprises a portion (14) configured for being fitted in a cavity (15) formed by the attachment of the first module (4) and of the second module (5).

5. Coupling device (1) according to any of claims 3-4, **characterized in that** the enclosure (10) comprises at least one handgrip (11) for handling the coupling device (1) when performing electrical coupling between a first set of busbars (2) and a second set of busbars (3).

6. Coupling device (1) according to any of claims 3-5, **characterized in that** the enclosure (10) comprises at least one mechanical connection point (13) for fixing the coupling device (1) with at least one module (4, 5).

7. Coupling device (1) according to any of claims 3-6, **characterized in that** the enclosure (10) comprises at least one slot (16) which allows cooling of the electrical coupling.

8. Coupling device (1) according to any of the preceding claims, **characterized in that** the device (1) is encapsulated in an insulating material.

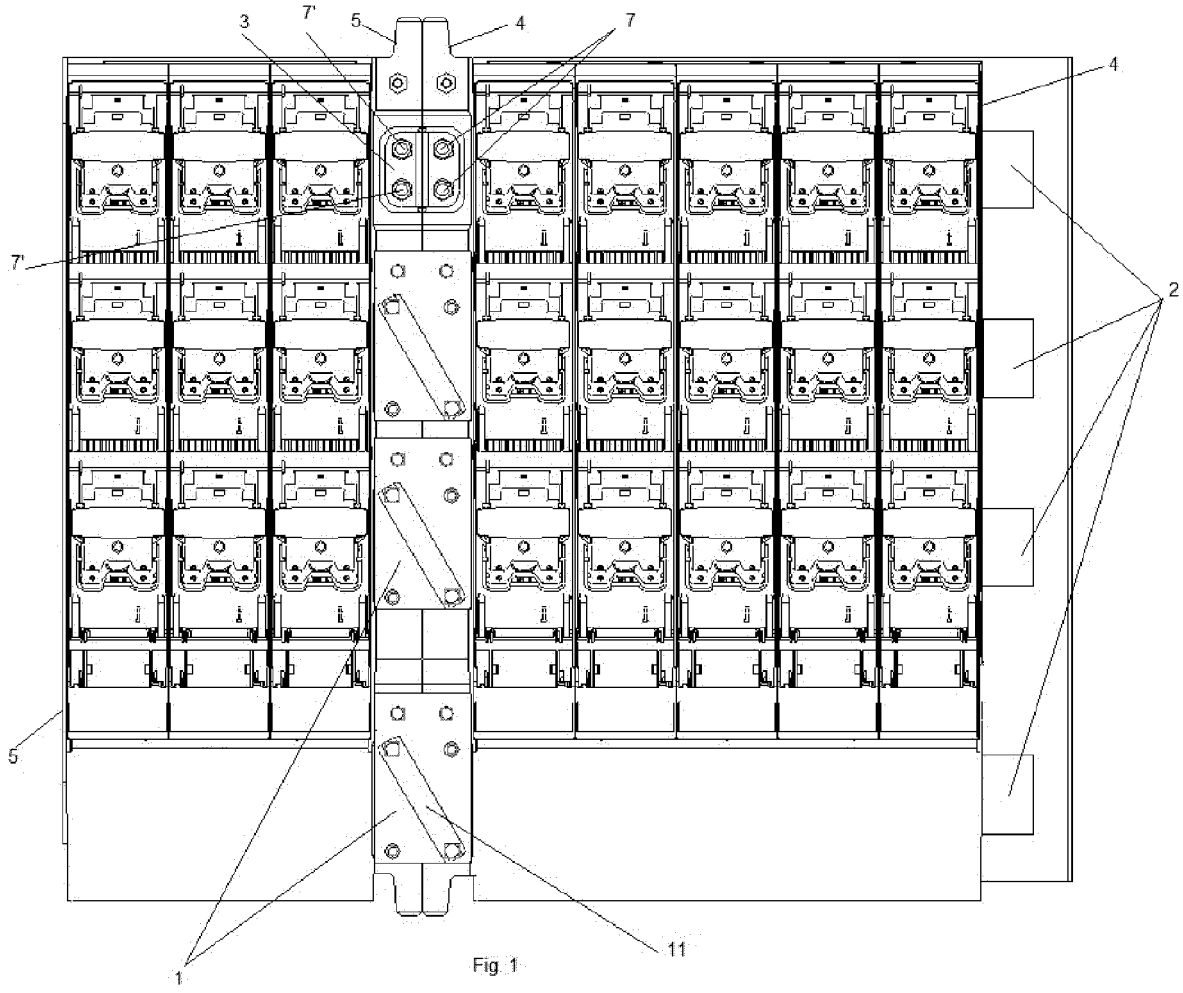

Fig. 1

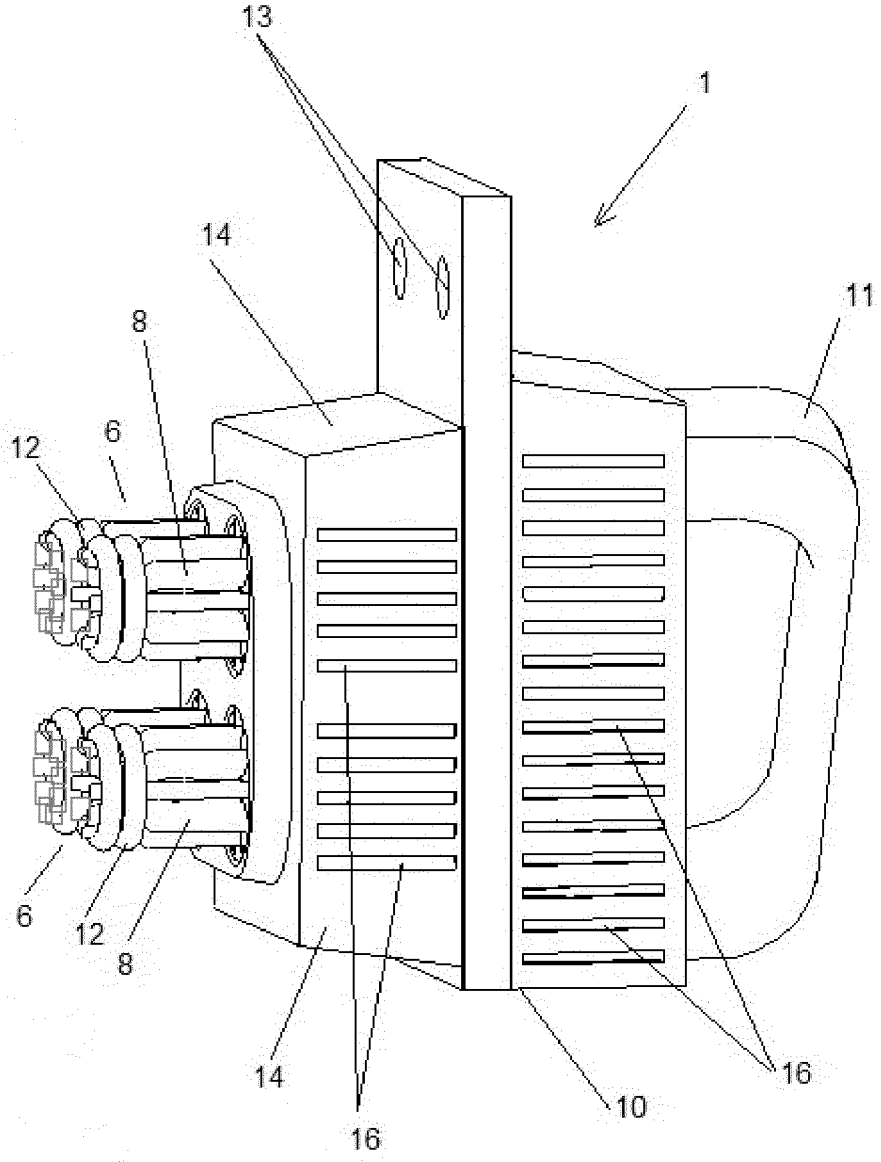

Fig. 2

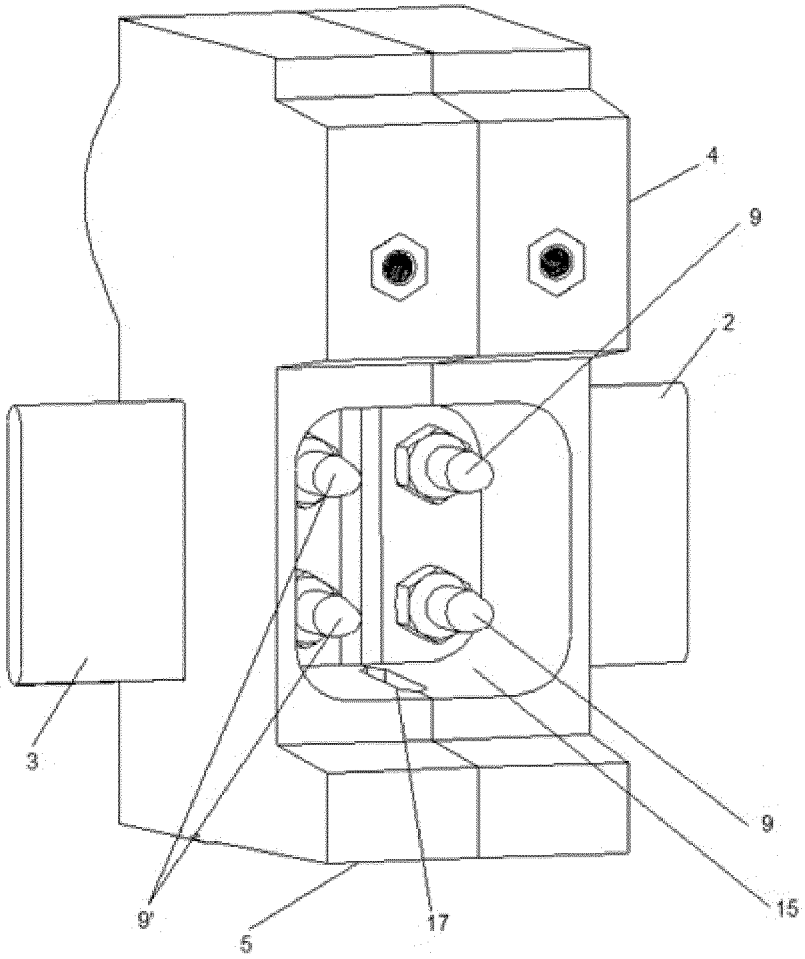

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 14 38 2052

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 June 2014	Gomes Sirenkov E M.

CATEGORY OF CITED DOCUMENTS

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