

ADAPTABLE PREFABRICATED LAMINATED BUSBAR SYSTEM AND A METHOD FOR ADAPTING THE  
LENGTH OF SAID BUSBAR SYSTEM

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## DESCRIPTION

**Field of the invention**

In its most general aspect, the present invention relates to the field of busways, also referred to as busbars, and particularly it relates to a conductive  
10 element for forming busways as well as to a method for adapting the length of such a conductive element.

**State of the Art**

Busways are power lines extending through the space along specified paths, and they usually consist of straight  
15 and angular conductive elements sequentially joined to follow the desired path and laid down with the aid of various auxiliary components.

The created path is used to transfer electric current in general as well as to deliver electric current to users  
20 connected thereto through withdrawal branches. Certain conductive elements are also adapted to be connected to one or more branch boxes in order to deliver current.

Each of the conductive elements cooperating for forming these busways usually consists of a casing, also  
25 referred to as profiled member, provided with an outwardly open compartment, current conductor rails extending longitudinally in the casing towards the interior of the compartment, and a cover or closing member for the

compartment which is secured to the casing generally by welding.

The conductor rails include phase rails, neutral rails and ground rails, the latter rails serving as protective  
5 conductors. All the bars are enclosed in an insulating sheath to prevent a direct contact therebetween.

In order to form an electrical path according to the desired pattern, the conductive elements are consecutively joined to each other by means of both an electrical  
10 junction and a mechanical junction.

The electrical junction is implemented by means of a joint, also referred to as a block, which includes two side walls and plates intervening therebetween which are isolated from each other and arranged in a pack. The plates  
15 are interposed in a comb-like fashion between the splayed ends of the conductor rails of every two consecutive members and then locked at the ends of the rail.

Generally, the electrical joint is associated with an end of each conductive element except for the last of the  
20 path, so as to be adapted to be connected to the joint-free end of the rails of another adjacent conductive element.

The electrical connection is completed by a locking bolt passing through the joint and screwed thereto to create a clamping torque in order to ensure a close contact  
25 between the conductor rails of the joint.

The mechanical junction is implemented by means of a flange to be connected to the casing and cover of adjacent conductive elements, generally with the use of screws.

A further solution provided in the prior art is described in document EP 1 079 492, which discloses a waterproof and conductive rail element comprising a junction assembly disposed between the ends of two casings  
5 and further comprising a waterproof cover removably associated with the two casings and having an access opening engaged by a plug provided with a complementary access opening, wherein water is drained from the upper edge of a casing to the lower edge of the same casing by  
10 means of spacers provided with draining channels.

Document US 4 735 577 describes a casing comprising an extruded member made of an insulating material, e.g. plastic, which defines a housing through which a conductive member is passed, said casing being provided with closure  
15 plates at the ends thereof and being provided with an upper wall having a plurality of openings for accommodating the respective electrical connections, and further comprising a cover for partially or completely closing the openings provided in the upper wall.

20 The conductive elements of the above-described type are advantageous, however, they are not free from drawbacks, including the main drawback that such conductive elements cannot be adapted in length as needed when a busway is laid down, i.e. in the construction site where it  
25 is installed.

In fact, the conductive elements usually have modular lengths which allow the conductive elements to be easily used in the formation of a busway comprising an integer

multiple of the length of these conductive elements, while the lay-down of a conductive element having a length smaller than the shortest available module or otherwise not corresponding to the predetermined length of the available  
5 modules requires that the conductive element would be made ad-hoc by skilled artisans working outside of and away from the construction site or place where the busway is laid down, for example at the manufacturer of the conductive elements.

10 Therefore, it results that the manufacturing costs and lead times of an ad-hoc busway are often inconveniently increased and may cause the on-going installation to be stopped since it requires and depends on resources external to the busway-manufacturing construction site in order to  
15 have conductive elements of a desired size, and specifically of a desired length which is intermediate to the available modular lengths or smaller than the minimum available length.

#### **Summary of the invention**

20 An object of the present invention is to remedy the above mentioned drawbacks and disadvantages of the prior art, and particularly to provide a conductive element for busways having a structure such as to allow an easy, extemporaneous adaptation of its length without  
25 compromising its functionality and robustness, and a corresponding method for adapting the afore said length.

Essentially, the invention proposes a conductive element for busways which can be assembled and disassembled

and whose length can be changed, specifically decreased, through a series of steps which are advantageously adapted for being implemented at the same construction site where a desired busway is installed, i.e. simultaneously to the  
5 lay-down thereof, without requiring skilled artisans or artisans external to said construction site and specialized equipment.

According to the invention, said conductive element comprises a casing formed by at least one profiled member,  
10 a plurality of conductor rails accommodated in the casing and having splayed terminals protruding from opposite ends of the casing and at least one grounding member, said conductive element further comprising at least one first connection for removably fastening the at least one  
15 grounding member to an end or head of the casing, said at least one first connection extending along the whole length of said casing.

Essentially, the invention provides a conductive element wherein said at least one grounding member is  
20 removably placed on at least one end or head of the casing and it can be accessed from the outside in order to be quickly assembled to or disassembled from the casing, due to the afore said at least one first connection extending along the whole length of the casing, therefore allowing  
25 the conductive element to be quickly assembled and disassembled.

Preferably, the conductive element according to the invention also comprises at least one second connection

associated with said at least one grounding member and intended for coupling one of its ends to an end of another adjacent conductive element through a respective joint cover, also serving to protect the ends of the conductor rails and to be connected to said at least one second connection by suitable means.

Preferably, the conductive element according to the invention also comprises at least one third connection associated with said at least one grounding member and through which the conductive element can be advantageously easily handled and moved, for example when it is mounted vertically, by a suitable means.

Preferably, said at least one first connection is arranged inside the body of the casing, more preferably it is formed integral with a wall of the casing, and advantageously it has a polygonal or circular section which is preferably open.

Preferably, there are provided a plurality of first connections of the above type arranged in positions symmetrical to each other with respect to a vertical or horizontal middle plane of the casing, the first connections being able to be advantageously provided in the form of grooves or throats obtained in the at least one profiled member and/ or in the form of juts protruding inside the profiled member.

Grooves or protrusions with a quadrangular section, particularly with a square or rectangular section, are preferable for the afore said upper wall of the profiled

member.

Preferably, the afore said at least one second connection is external to the body of the casing, and more preferably it is extended substantially along the entire height of the casing and therefore along the entire height of the at least one grounding member.

Preferably, the afore said at least one second connection is integral with the at least one grounding member, and advantageously it has a polygonal or circular section which is preferably open.

Advantageously, said at least one grounding member comprises a first plate-like portion for closing the head of the casing, and a second plate-like portion attached to the first plate-like portion and substantially orthogonal thereto which follows the course of the afore said splayed terminals of the conductor rails.

The above two plate-like portions of the at least one grounding member are substantially arranged to form a T in which said at least one second connection is jutting from one of them, preferably from the afore said first plate-like portion.

Preferably, the afore said at least one third connection is external to the body of the casing, and more preferably it is extended substantially along the entire height of the casing and therefore along the entire height of the at least one grounding member.

Preferably, said at least one third connection is formed integral with the at least one grounding member, and

more preferably it corresponds to a right-angle folded edge of an end portion of the afore said first plate-like portion.

Actually, the afore said at least one third connection  
5 is preferably a sort of hook formed by a free end portion, substantially a lip, of the afore said at least one grounding member.

Further, the conductive element according to the invention preferably includes means for stiffening the  
10 afore said at least one grounding member, particularly but not limited to, of the second plate-like portion which is advantageously shaped as a lightning bolt, and contrasting means associated with the second plate-like portion and advantageously adapted for maximizing the contact with the  
15 walls of an electrical joint of the type used in the electrical junction of the conductor rails of two adjacent conductive elements.

Preferably, the afore said stiffening means and said contrasting means are formed integral with said at least  
20 one grounding member.

According to the invention, the present busway may also comprise two grounding members of the above said type, each associated with a respective end of the afore said casing or both associated with a same end of the casing on  
25 opposite sides of the splayed terminals of the conductor rails.

Preferably, the conductive element according to the invention also includes a gasket intervening between the at

least one grounding member and the end portion of the casing to which it is removably combined.

Preferably, the conductive element according to the invention also includes a protective enclosure placed  
5 around the casing and having a length essentially corresponding to, or greater than, that of the casing by a predetermined, limited amount.

According to the invention, this conductive element made of any modular length, for example a length customary  
10 to the relevant field, is suitable to be sized as needed and particularly to be shortened, for example for completing a section of busway, through a series of operations which may be carried out quickly, if necessary, at the same construction site or place where the busway is  
15 installed, without compromising any features of functionality, robustness and handling thereof.

For this purpose, the present invention provides a method for adapting the length of a conductive element of the above type, comprising the steps of:

20 opening at least one head of the conductive element by removing the afore said at least one grounding element from the afore said end of the casing;

removing the afore said conductor rails from the afore said casing;

25 cutting to size the conductor rails and cutting to size the casing;

forming again the splayed terminals of the conductor rails from the cut side;

inserting the afore said cut to size conductor rails into the afore said cut to size casing so as to have splayed terminals protruding from opposite ends of the casing;

- 5 combine the afore said at least one grounding member to the cut to size casing by means of the afore said fastening means cooperating with the afore said at least one first connection extending inside the casing.

Advantageously, the casing may be cut to size either  
10 when the same is assembled or when it is disassembled, in case it consists of more profiled members.

In this second case, the individual members constituting the casing may be disassembled before being cut and then cut to size and re-assembled after being cut  
15 to size.

In case of a conductive element having a protective enclosure of the above said type, the casing may also be cut to size either when it is provided with the protective enclosure or after the removal of the protective enclosure  
20 from the casing with a separate cutting operation.

Further characteristics and advantages of the present invention will be apparent from the following description of a preferred example of embodiment, given for illustration purposes and without limitation, with  
25 reference to the accompanying figures.

#### **Brief description of the figures**

Fig. 1 shows a perspective view of a conductive element for a busway according to an embodiment of the

present invention;

Fig. 2 shows a cross-sectional view of the conductive element of Figure 1;

Fig. 3 shows a detail of two conductive elements of the type as shown in Fig. 1 which are joined to each other by means of an electrical junction;

Fig. 4 shows separately the essential components of a conductive element according to the invention to be resized in length;

Fig. 5 shows an enlarged detail of the assembly in Fig. 4;

Fig. 6 shows an enlarged detail of a plan view of the conductive element of Figure 1.

#### **Detailed description**

With reference to Figures 1-2, a conductive element adapted for forming busways according to the invention is generally designated by reference numeral 1, and it essentially comprises a casing 2, a plurality of conductor rails 3 accommodated in the casing 2, a plurality of grounding members 4, a plurality of first connections 5 for removably connecting each grounding member 4 to the casing 2 by means of respective combining means 6, and a protective enclosure 7 positioned around the casing 2.

In the example of Fig. 3 there are shown two head portions of two respective conductive elements of the above said type as joined to each other by means of an electrical junction.

Particularly, the casing 2 comprises two profiled

members 10 formed by respective box-like bodies disposed at a predetermined distance from each other to form a compartment for accommodating the conductor rails 3, and a pair of auxiliary profiled members 11 arranged opposite to each other with respect to the profiled members 10 and positioned so as to connect said profiled members as well as to close said compartment.

In detail, each profiled member 10 comprises a pair of mutually parallel and opposite side walls 12, 13, one of which is provided with a longitudinally extending opening 14, and a pair of mutually parallel and opposite joining walls 15 extending between the side walls 12, 13.

The opening 14 of each profiled member 10 is extended along the whole length of the casing 2 at a middle position equally spaced from the joining walls 15 and, in both the profiled members 10 of the examples of Figures 1 and 2, it is directed away from the compartment for the conductor rails, however, the openings 14 can be also directed towards the compartment of the casing 2 as defined by the two profiled members 10, as shown in the example of Figure 3.

Furthermore, each side wall 12, 13 of the profiled members 10 comprises opposite end portions defining a step designated by reference numeral 16, each end portion being adjacent to a respective joining wall 15, which joining walls are extended parallel to the opening 14.

With regard to the auxiliary profiled members 11, there is to be added that they are external to the two

profiled members 10 and each comprises a central wall 17 and orthogonal end portions protruding from both the sides of the central wall 17.

Particularly, each auxiliary profiled member 11  
5 comprises a pair of first orthogonal members 18 each fitting with a step 16 of a respective profiled member 10, and a pair of second orthogonal members 19 extending away from the first orthogonal members 18 and having respective right-angle folded ends 20.

10 With regard to the conductor rails 3, there is to be added that they have splayed terminals 21 protruding from opposite ends of the casing 2.

According to a first aspect of the invention, the  
afore said first connections 5, which are preferably  
15 arranged in the casing 2 symmetrically with respect to a middle plane - horizontal or vertical - of the conductive element 1, are extended internal to the box-like body of each profiled member 10 and parallel to the opening 14 along the whole length of the casing 2, as shown in the  
20 examples of the Figures, however, said first connections may also be arranged in a different manner.

In the illustrated examples, the first connections 5  
are six in number per profiled member and they are adapted  
for cooperating with combining means 6 to fasten a  
25 respective grounding member 4 at opposite end portions of each profiled member 10.

In the examples of the Figures, the first connections  
5 are associated internally with the walls of the profiled

members 10, and particularly they take the form of juts formed integral with the profiled members having an open circular cross-section, however, their section may also be either a closed circular section or a closed or open  
5 polygonal section, and alternatively or in addition to the above, it is possible to provide first connections in the form of grooves or throats provided inside the walls of the profiled members, the latter embodiment not being shown in Figures.

10 In this regard, if desired, each grounding member 4 can include pre-formed through-holes to be engaged by said combining means, e.g. screws, at positions corresponding to the first connections 5.

According to a further aspect of the invention, in  
15 accordance with a preferred embodiment and as illustrated in the examples of the Figures, the conductive element 1 also comprises a plurality of second connections 51, each associated with a corresponding grounding member 4 for mechanically connecting one of its ends to an end of  
20 another adjacent conductive element, through a relative joint cover, not shown in the figures, to be fixed by suitable means, e.g. screws, cooperating with the second connections.

Particularly, said joint cover also serves to protect  
25 the splayed ends of the conductor rails of two adjacent conductive elements connected to each other by means of an electrical joint of the type illustrated in the example of Figure 3, as will become more evident from the following.

Said second connections 51 are external to the casing body and each is extended substantially orthogonal to the first connections 5 substantially along the entire height of the casing, therefore along the entire height of the  
5 respective grounding member 4.

Advantageously, the second connections 51 are made integral with the respective grounding member and, similarly to the first connections 5 according to the examples of the Figures, they have an open circular  
10 section, however, they may also provide a different cross-section as set forth above.

Further with regard to the grounding members 4, there is to be added that each of them essentially comprises a first plate-like portion 41 for closing the head of the  
15 casing, and a second plate-like portion 42 substantially orthogonal to the first plate-like portion 41 and following the course of the splayed terminals 21 of the conductor rails 3.

Actually, in each grounding member 4, the two first  
20 and second plate-like portions are arranged to form a sort of "T" in which the respective second connection is jutting from one of them, and it is advantageously formed integral with the first plate-like portion 41.

According to a further aspect of the invention, in  
25 accordance with a preferred embodiment and as illustrated in the examples of the Figures, the conductive element 1 also comprises a plurality of third connections 61, each associated with a respective grounding member 4 for moving

the conductive element, particularly for easily handling the conductive element when it is assembled vertically during the formation of a busway.

The afore said third connections are external to the casing body and each is extended substantially orthogonal to the first connections 5 substantially along the entire height of the casing, therefore along the entire height of the respective grounding member.

Advantageously, the third connections 61 are formed integral with the respective grounding member, and advantageously they comprise a right-angle folded edge of an end portion of the relative first plate-like portion.

Furthermore, as illustrated in the Figures, the conductive element according to the invention comprises means 43 for stiffening each grounding member, particularly but not limited to the respective second plate-like portions which are advantageously shaped as a lightning bolt, and contrasting means 44 jutting from the second plate-like portions of each grounding member in order to maximize the contact with the walls of an electrical joint 23, as shown in the example of Figure 3.

In particular, the stiffening means 43 and the contrasting means 44 are formed integral with the respective grounding member and take respectively the form of a bracket extending between intermediate portions of the first and second plate-like portions and ribs, for example obtained by punching, as shown in the example of Figure 6.

Furthermore, the conductive element 1 comprises a

gasket 22 peripherally placed between each end of the casing 2 and the respective grounding members 4 associated with the respective profiled members 10.

With regard to the electrical junction between two  
5 conductive elements 1, it is formed during the lay-down of the busway by means of the afore said joint 23 which electrically connects the rails of a conductive element to the rails of an adjacent conductive element, as shown in the example of Figure 3.

10 Particularly, the joint 23 comprises a plurality of plates 24 insulated from each other, arranged in a pack between two side walls 25 and intended for being interposed between the splayed terminals of the conductor rails and crossed by a pair of clamping bolts 26.

15 The grounding members 4 of the two conductive elements joined by means of the electrical junction are interposed between each side wall 25 and the respective adjacent plate 24, thus causing the conductive element to be grounded as desired.

20 It should be understood that the casing described above and illustrated in the examples of the Figures is a preferred type, and that the present conductive element according to the invention may comprise a casing formed by one profiled member, and consequently one grounding member  
25 per conductive element can also be provided.

According to a further aspect of the invention, the conductive element 1 described above and made of any modular length, is adapted to be resized as needed,

particularly to be shortened, through a series of operations which can be carried out quickly, if necessary at the same construction place or site where the busway is installed, as mentioned above.

5        Particularly, according to the invention, the present conductive element can be resized in length by a method comprising the steps of:

opening a head of the conductive element 1 by removing a grounding member 4 from the casing 2, particularly from  
10 the end of one of the profiled members 10, with the removal of the combining means 6 from the first connections 5;

removing the conductor rails 3 from the casing 2;

cutting to size the conductor rails and cutting to size the casing;

15        forming again the splayed terminals of the cut conductor rails;

inserting the cut to size conductor rails into the cut to size casing so as to have splayed terminals protruding from the opposite ends of the casing;

20        coupling the previously removed grounding member 4 to the cut to size casing 2 by fastening the combining means 6 to the first connections 5.

Optionally, before the casing 2 is cut to size, it may be removed from the protective enclosure 7 if provided and  
25 then cut to size and re-accommodated into the casing which has been also conveniently shortened.

In other words, the protective enclosure 7 may be cut to size separately or simultaneously to the cutting of the

casing 2.

Furthermore, if the casing consists of more profiled members, it can be disassembled in order to allow the individual profiled members, i.e. the profiled members 10 and the auxiliary profiled members 11 in the case shown in the illustrated examples, to be cut to size and then reassembled.

The advantages of the present invention, as already evident from the description set forth above, may be summarized in that the invention provides a conductive element for busways which is adapted for being extemporaneously sized in length through a series of operations which may be carried out at the same construction site or place where the busway is installed, without requiring skilled artisans or otherwise artisans external to the construction site and specialized equipment, while preserving all the features of the conductive element and particularly its features of functionality, robustness and handling.

Due to the particular structure of the conductive element comprising at least one grounding member external to the casing and removable therefrom, and at least one connection for the grounding member which is extended along the whole length of the casing, the conductive element can be resized in length simply by cutting to size the casing and the conductor rails, as well as the protective enclosure if needed, and then forming again the original configuration of all the components cooperating for forming

the conductive element.

The fact that the method according to the invention can be implemented at the same site where a busway is made, and therefore the availability of conductive elements of the desired intermediate length with respect to the available modular lengths, results in an advantage in terms of manufacturing costs and lead times of the busway.

In preferred embodiments described herein, a further advantage of the present invention is the presence of the second and third connections provided on the one or more grounding members removably constrained to the casing, which allow the cover jointing two conductive elements to be removably coupled and the conductive element to be easily moved and handled when a busway is laid down, particularly for vertical arrangements, and which further allow to preserve these advantages even after the conductive element according to the invention has been resized as desired. One skilled in the art can make various modifications and changes to the conductive element and method for adapting the length thereof as described in the various embodiments set forth above in order to satisfy specific and contingent needs without departing from the scope of the invention as defined by the following claims.

A person skilled of the art will be able to make various changes and variations to the profiled element and method for adapting the length thereof described above in the various illustrated embodiments to satisfy contingent and specific requirements, on the other hand all contained

in the protection scope of the invention as defined in the following claims.

## CLAIMS

1. Conductive element (1) for forming busways, comprising a casing (2) composed of at least one profiled element, a plurality of conductor rails (3) housed in the casing (2) and having splayed terminals (21) protruding from opposite ends of said casing (2) and at least one grounding element (4), characterized by further comprising at least one first connection (5) extended for the whole length of said casing (2) and fastening means for the removable coupling of said at least one grounding element (4) with one end of said casing (2) cooperating with said at least one first connection (5).

2. Conductive element according to claim 1, further comprising at least one second connection (51) constrained to said at least one grounding member for removable coupling with a cover for jointing and protecting said splayed ends (21) of said conductor rails (3).

3. Conductive element according to claim 1 or 2, further comprising at least one third connection (61) constrained to said at least one grounding member (4) for vertically moving said conductive element.

4. Conductive element according to any one of the preceding claims, wherein said at least one first connection (5) is internal to the body of said casing (2).

5. Conductive element according to any one of the preceding claims, wherein said at least one first connection (5) is either a groove or throat formed in said wall of said casing, or an object protruding therefrom and

having a polygonal or circular section which is preferably open.

6. Conductive element according to any one of the preceding claims, comprising a plurality of said first  
5 connections (5) disposed in reciprocally symmetrical positions relatively to a vertical or horizontal median plane of said casing (2).

7. Conductive element according to any one of claims 2-6, wherein said at least one second connection (51) is  
10 external to the body of said casing (2) and it is extended substantially along the entire height thereof, said at least one second connection (51) having a polygonal or circular section which is preferably open.

8. Conductive element according to any one of claims 2-7, wherein said at least one grounding member comprises a  
15 first plate-like portion (41) for closing said casing (2), and a second plate-like portion (42) constrained to said first plate-like portion and following the course of said splayed terminals (21) of said conductor rails (3).

20 9. Conductive element according to claim 8, wherein said at least one second connection (51) is jutting from said first plate-like portion (41).

10. Conductive element according to any one of claims 3-9, wherein said at least one third connection (61) is  
25 external to the body of said casing (2) and it is extended substantially along the entire height thereof.

11. Conductive element according to any one of claims 8-10, wherein said at least one third connection (61) is

constituted by a right-angle folded edge of an end portion of said first plate-like portion (41).

12. Conductive element according to any one of the preceding claims, comprising two of said grounding elements (4) coupled with the same end of said casing (2) by portions opposing to said splayed terminals (21) of said conductor rails (3).

13. Method for adapting the length of a conductive element according to any one of the preceding claims, comprising the steps of:

opening at least one head of said conductive element (1) by removing said at least one grounding element (4) from said end of said casing (2);

removing said conductor rails (3) from said casing;  
15 cutting to size said conductor rails (3) and cutting to size said casing (2);

forming again said splayed terminals (21) from the cut portion of said cut conductor rails;

inserting said cut to size conductor rails in said cut to size casing in order to get splayed terminals protruding from opposite ends of said casing;

fastening said grounding element (4) to said cut to size casing by said removable combining means cooperating with said at least one first connection.

25 14. Method according to claim 13, wherein said casing is disassembled and the individual components are cut to size in length, then assembled again.