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Remarks:

Amended claims in accordance with Rule 137 (2) EPC.

(54) **Concealed and preferably leaktight electrical butt joint for prefabricated lengths of electrical ducting, preassembled with one of the lengths.**

(57) Concealed and leaktight electrical butt joint for prefabricated lengths (1, 69) of electrical ducting, in which a metal enclosure (2, 70) houses at least one support (3) of insulating material having a plurality of rectilinear slots in each of which is housed a conducting bar, the extremities of the support (3) being spaced apart by the enclosure (2), the joint comprising a metal saddle (19) which is inserted to half its length in the extremity of the enclosure (2) on the first length (1) of ducting and its other half in the extremity of the enclosure (70) of a second length (69) abutting the first, the saddle extending in two side members (25, 26) within which there is fixed, to at least one of these side members, in a median position thereof, an electrical connector (20, 21) having the shape of a sleeve which is leaktightly fitted onto the end of the support (3) of each of the lengths which are to be joined, the joint being factory preassembled with one of the lengths.

sure (2) on the first length (1) of ducting and its other half in the extremity of the enclosure (70) of a second length (69) abutting the first, the saddle extending in two side members (25, 26) within which there is fixed, to at least one of these side members, in a median position thereof, an electrical connector (20, 21) having the shape of a sleeve which is leaktightly fitted onto the end of the support (3) of each of the lengths which are to be joined, the joint being factory preassembled with one of the lengths.

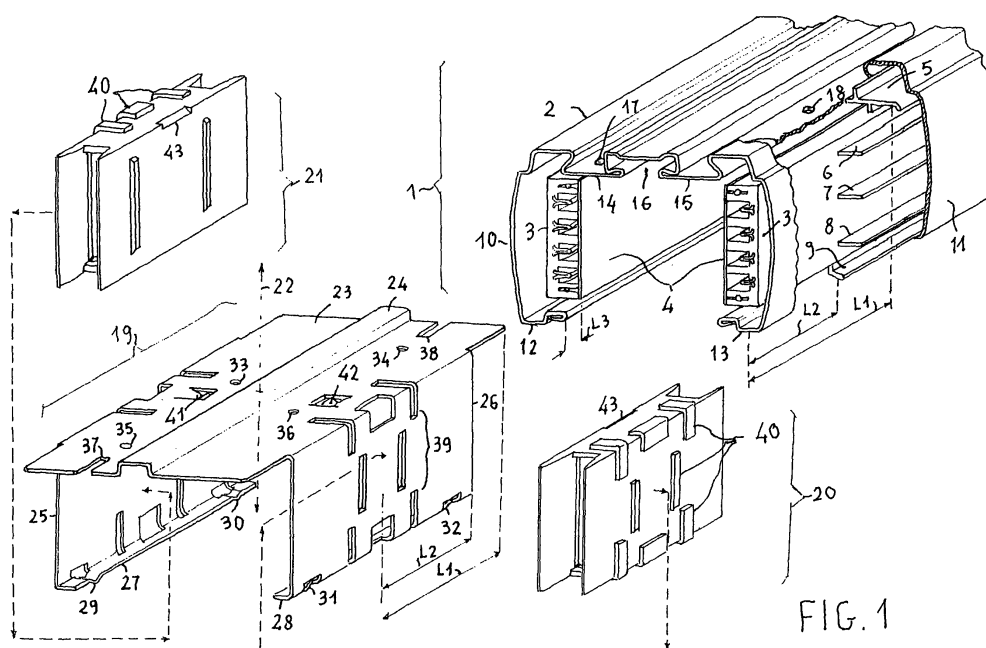


FIG. 1

Description

[0001] This invention relates to a concealed and preferably leaktight electrical butt joint for prefabricated lengths of electrical ducting, in particular suspended or more generally "on sight" ducting, the joint being preassembled or capable of preassembly with one of the lengths.

[0002] It is known that in public buildings, offices, shopping centres and the like electrical power is very often distributed by the means of suspended visible electrical ducting which can be configured according to various requirements and to which electrical connections can be made at any point along its length by means of electrical plugs inserted into the ducting.

[0003] This ducting is constructed by connecting together prefabricated modular elements or lengths which must satisfy a plurality of requirements, such as system safety, simplicity and convenience of installation, a very important factor for suspended ducting, leaktight electrical components and, not last, compliance with aesthetic standards.

[0004] These requirements must also be satisfied by the devices or joints which mechanically and electrically connect together the different prefabricated modular elements making up the system.

[0005] Reconciling all these requirements generally requires the solution of a variety of problems which are only partly solved by the known art, satisfying some of the requirements to the detriment of others.

[0006] For example US 5,614,697 provides electrical ducting comprising prefabricated leaktight modular elements which are connected end to end by means of junction devices which ensure a leaktight connection but which are aesthetically unsatisfactory because they interrupt the continuity of the shape of the ducting with visible projecting parts.

[0007] In addition to this, installation of the joint is laborious because the joints cannot be preassembled with one length of ducting in the factory, but must be assembled in situ.

[0008] The present invention overcomes these problems and provides an electrical butt joint which is leaktight, invisible, that is wholly contained and hidden within the ducting, and which can be preassembled with a ducting element, rendering the operation of joining lengths at the site of installation particularly simple and easy.

[0009] In addition to this it has an extremely simple low cost structure which is easy to manufacture and which can be assembled with electrical modules and a single mechanical component to satisfy various application requirements.

[0010] The invention is characterised by the claims and its advantages will be more apparent from the following description of a preferred embodiment with reference to the appended drawings, in which:

- Figure 1 is an exploded perspective view of a pre-

ferred embodiment of an electrical butt joint and a terminal portion of a length of electrical ducting to which the joint is intended to be connected,

- Figure 2 is an exploded perspective view of a preferred embodiment of the electrical connector for the joint in Figure 1,
- Figure 3 is a perspective view of the joint in Figure 1 preassembled with the end of a length of ducting.

[0011] With reference to Figure 1, before going into the specific detail of the modular interconnection system it is advisable to consider a preferred embodiment of the length of ducting to which the butt joint is intended to be connected.

[0012] Length of ducting 1 essentially comprises a rectilinear metal enclosure 2 of bent sheet or extruded light alloy forming a channel open beneath on the sides of which are housed two identical rectilinear supports 3 extruded from insulating plastics material.

[0013] According to the requirements of the application enclosure 2 may house only one of the two supports.

[0014] In support 3, which has a transverse rectangular cross-section, there is formed a plurality of rectilinear parallel slots open on one side of the support, in each of which a conducting member is housed.

[0015] In the preferred embodiment, illustrated in Figure 1, the slots are six in number and house four conducting bars having a T cross-section coextruded with the support (the material of which includes the butt end) for the distribution of a three phase voltage/current system and its neutral, as well as two conducting bars of circular cross-section for an auxiliary single-phase voltage.

[0016] The slots are hermetically sealed, except at their ends, by an insulating perforatable plastics sheet 4 welded or extruded over the entire surface of the support into which the slots open.

[0017] As shown in the detail in Figure 1, in which enclosure 2 is partly removed to show its interior, on the side of support 3 opposite that onto which the slots open and on the bottom and top surfaces of the support there are spacing ribs 5, 6, 7, 8, 9 which position the support at a convenient distance from the inner face of enclosure 2.

[0018] Spacing ribs 5 and 9 also bring about snap connection of support 3 onto enclosure 2, which is suitably shaped for the purpose.

[0019] In particular the side walls 10, 11 of enclosure 2 end at the bottom in an internally bent saddle 12, 13 which acts as a rest for supports 3 and into which rib 9 of the supports is inserted.

Incidentally the free extremities of the two saddles 12, 13 form a continuous engaging tooth for snap attachment of a removable panel closing the enclosure.

[0020] In turn the upper wall of the enclosure has a pair of internal ribs 14, 15 separated by a channel 16.

[0021] Rib 5 of supports 3 snap engages the sides of ribs 14, 15.

[0022] For a more detailed description of this ducting, which is not essential for the purposes of this invention, reference should be made to European patent application EP06425836.1 filed on the 14/12/2006.

[0023] It is important to note here that spacer ribs 5, 6, 7, 8, 9, even if obtained by the process of extruding support 3, do not extend over the entire length of the support but, as illustrated in Figure 1, are interrupted as a result of partial removal therefrom by milling or cutting in the course of the production process to a convenient distance from the extremity of enclosure 2. This applies to the other extremity, which is not illustrated.

[0024] In particular, rib 5, which extends from the top surface of the support, is interrupted at a convenient distance L1, while the other ribs 6-9 are interrupted at a convenient distance L2 which is smaller than L1.

[0025] In this way the extremity portion of support 3 has no encumbrances outside its rectangular cross-section over a length of the enclosure equal to L2.

[0026] It should also be noted that the extremities of supports 3 are not flush with the extremity of enclosure 2, but are set further back from the latter by a convenient distance L3.

[0027] This is for reasons which will be more apparent below.

[0028] Finally it will be noted that ribs 14, 15 have holes 17, 18 at a convenient distance from the extremity of enclosure 2, obviously made in the course of the production process, for the insertion of fixing rivets or threaded inserts attached to the enclosure by calking, again in the course of the production process.

[0029] In its details Figure 1 shows only one extremity of the length of ducting, but it is clear that the opposite extremity has the same appearance.

[0030] In point of fact the only difference may be that while one of holes 17, 18 is provided with a threaded insert (hole 18 in Figure 1) at one extremity, the threaded inserts are absent at the other extremity.

[0031] In order to connect lengths of ducting such as that described, in which only one of supports 3 may be present, together mechanically and electrically, a modular joint comprising a saddle 19 obtained by cutting and bending metal sheet and at least one electrical connector 20 or, depending on user needs, a pair of identical electrical connectors 20, 21 are conveniently used.

[0032] Saddle 19, having a profile which is symmetrical with respect to a vertical axis 22, comprises a rectangular plate 23 extending over a length equal to 2L1 (indicatively 300 mm) and a width (indicatively 79 mm) such that it can be inserted with some play into enclosure 2, alongside ribs 14, 15.

[0033] Plate 23 has a rib 24 in the direction of its length which is inserted with minimal play into channel 16 of enclosure 2.

[0034] The plate extends laterally as two parallel side members, 25, 26 which are bent downwards and end in two lips 27, 28 parallel to plate 23 and facing each other.

[0035] The length of the side members in the direction

of rib 24 is equal to 2L2 (indicatively 206 mm) and their size is such that they can be inserted within enclosure 2 with some play without interfering with supports 3, with the lips located within saddles 12, 13 of the enclosure.

[0036] Obviously ribs 5, 6, 7, 8, 9 of support 3 (or of the supports) form a stop which defines the depth to which saddle 19 can be inserted into the enclosure, which is equal to exactly half the longitudinal length of the saddle.

[0037] In order to take up vertical play lips 27, 28 are provided with projections 29, 30, 31, 32 at their extremities (obtained in the cutting and bending process) which extend downwards and are relatively yielding (to be specific as a kind of leaf spring) which, interfering with saddles 12, 13 of enclosure 2, press plate 23 into contact with ribs 14, 15 of the enclosure.

[0038] For its part, rib 24, by engaging in channel 16, ensures precise transverse and axial positioning of saddle 19 relative to enclosure 2.

[0039] Suitable openings 33, 34, 35, 36 and grooves 37, 38 are provided in plate 23 and when saddle 19 is inserted into two abutting enclosures they align with corresponding openings 17, 18 provided in the enclosures and allow the saddle to be attached to the enclosures by means of rivets if the saddle is preassembled with one of the enclosures or by means of a screw engaging the threaded insert provided bevelled in opening 18 in the case of in situ assembly.

[0040] The purpose of this is to avoid having to have a riveter available at the point of installation, assembly being then effected using an ordinary screwdriver.

[0041] Assembly is further simplified by partly pre-screwing the screw into the threaded insert bevelled in hole 18 to which groove 38 in plate 23 corresponds, so that the presence of the screw does not interfere with the insertion of plate 23 into the enclosure.

[0042] In this way assembly is reduced to merely screwing up the screw.

[0043] In order to connect connectors 20, 21 to saddle 19, the latter is further provided with appropriate openings collectively identified by the reference number 39 into which corresponding ribs projecting from the outer walls of the connectors are housed, these being also collectively identified by the reference number 40.

[0044] The connection between openings 39 and ribs 40 ensures that the connectors are accurately positioned on the inside of side members 25, 26 and prevent any dislocation of the connectors when saddle 19 is inserted into each of the two enclosures which have to be butt joined.

[0045] Connectors 20, 21 are anchored in saddle 19 by two corresponding resilient tongues 41, 42 formed in plate 23 by cutting and bending.

[0046] These tongues form a pair of teeth which make a snap connection with one edge of the connectors provided for the purpose with a convenient recess 43, the teeth pressing the connectors in contact with the inside of side members 25, 26.

[0047] Connectors 20, 21 essentially comprise prismatic sleeves of insulating plastics material which when saddle 19 is inserted into the ends of two lengths of ducting fit onto the ends of supports 3 housed therein.

[0048] Double metal clamps are provided within the connectors.

[0049] The clamps, by penetrating the slots in the supports 3 without interfering with plastics sheet 4 which hermetically seals the slots clasp the extremities of the conducting bars housed therein between the clamps.

[0050] For completeness of description Figure 2 shows a preferred embodiment of these connectors in an exploded perspective view.

[0051] The connector in Figure 2 comprises two shells 44, 45 of insulating plastics material open at the ends which are coupled together with a partial overlap of edges 46, 47.

[0052] In one of the shells, namely shell 44, at the extremities of each of the two coupling edges 46, 48, a pair of teeth 49, 50 is provided (only one pair can be seen in Figure 2).

[0053] The teeth project externally and form a snap connection with corresponding relatively resilient eyes 51, 52, 53 (a fourth is not visible) formed on the coupling edges of the other shell 45.

[0054] Once the two shells have been snapped together, the overlapping edges are conveniently welded together by ultrasonic welding to form a leaktight joint.

[0055] Close to the open extremities the two shells are provided internally with a resilient seal 58, 59 which is conveniently but not necessarily co-moulded together with the shells.

[0056] The internal transverse cross-section of the sleeve so formed is substantially identical to that of supports 3 (Figure 1) so that the sleeve can be fitted onto the extremities of the two supports 3 which abut together and ensure a leaktight joint.

[0057] In order to assist insertion of the extremities of the support into the sleeve, the latter is provided with fins 54, 55, 56, 57 with a wedge-shaped cross-section which project from the two openings. These fins make it possible to align the sleeve and the extremities of the supports precisely in the transverse direction so that insertion takes place without damage to insulating plastics sheet 4 (Figure 1) which hermetically seals off the recesses in which the conducting bars are housed.

[0058] Within the two shells 44, 45, in their median portion, there are a plurality of dividing septa and teeth, collectively and respectively identified by reference numbers 60 and 61, which form a plurality of housings for double electrical contact clamps equal in number to the number of connecting bars which have to be connected, only one of which, 62, is shown correctly positioned in its housing for ease of drawing.

[0059] Figure 2 again shows a preferred embodiment of the contact clamps, in an exploded view, these comprising a contact member 63 obtained by the double bending of a tin-coated or silver-coated copper plate, H

shaped by die-cutting, and a leaf spring 64, also obtained by double bending an H-shaped spring steel (or stainless steel) plate.

[0060] Spring 64, which is mounted so as to overlap contact member 63, in the form of a saddle, exerts the necessary contact pressure on pair of clamps 65, 66 formed by contact member 63.

[0061] A simpler form of double contact clamp comprising a single contact member, in this case made of phosphor bronze and identified by reference number 67, can be used to connect the auxiliary voltage conductors, which in general have to carry lesser currents of the order of a few amperes.

[0062] As an alternative multiple contact cage clamps may be used, with a possible steel compressing spring, once part of the insulating material of support 3 has been removed from the end of supports 3 by milling so as to expose the entire extremity of the auxiliary voltage conductors.

[0063] In Figure 2 the longitudinal extent (that is in the direction of insertion of supports 3) of dividing septa 60 is equal to the dimension of teeth 61 in the same direction and equal to twice L3 (Figure 1).

[0064] This is to prevent interference with supports 3 when these are inserted into the connector.

[0065] It is however obvious that in order to improve insulation between the conductors, in terms of surface resistance, dividing septa 60 may be of greater length, always between resilient seals 58, 59, once suitable channels have been made to receive these extensions at the extremity of supports 3.

[0066] Figure 3 shows the joint described above pre-assembled in the factory with length of ducting 1, in perspective view.

[0067] It can be clearly seen that metal saddle 19 is half inserted into metal enclosure 2 of the ducting and is attached thereto by rivets, one of which, 68, can be seen in the figure.

[0068] Sleeve connectors, one of which 21 can be seen in the figure, and each of which is fitted to half its length over the extremity of a corresponding support 3 for conducting bars, are correctly anchored within the saddle.

[0069] It will not however be forgotten that the modular nature of the joint (and the lengths of ducting) makes it possible to provide for the presence of only one connector in the joint, located inside only one of the sides of the saddle.

[0070] Preassembly of the joint with a length of ducting simplifies the work of in situ installation.

[0071] As shown in Figure 3, the butt joint between two lengths of ducting 1 and 69 simply requires the two lengths to be abutted together and the exposed part of saddle 19 to be inserted into second ducting 69.

[0072] When the operation is performed with length 1 already fitted and suspended it is obvious that saddle 19 acts as a supporting saddle for length 69 which has to be connected, and the operation is rendered easier.

[0073] Once insertion is complete, length 69 may be attached to length 1 with a screw passing through groove 37, which has been prescrewed in a threaded insert provided in the extremity of enclosure 70 of length 69.

[0074] The screw is tightened using an ordinary screwdriver inserted into enclosure 70 through its bottom opening.

[0075] As an alternative, if this is considered more convenient, or at the same time, it is also possible to provide one or two threaded inserts, such as insert 71 in Figure 3, located on rib 24 of saddle 19 into which inserts tightening screws are inserted through openings 72 provided in enclosure 70, in this case screwed up from above, that is from the top of the enclosure.

[0076] It should be noted that attachment of the saddle to the two enclosures by means of screws or rivets ensures electrical continuity between the enclosures, so that these can be used as earth conductors.

[0077] A preferred embodiment has been presented in the above description and the appended figures, but it is clear that many variants may be provided.

[0078] For example, saddle 19, instead of enclosing connectors 20, 21 within it (Figure 1), a preferred solution because in this way the connectors are protected by the saddle during all the stages of preassembly, movement and installation of the joint, may be provided for mounting connectors externally to its sides.

[0079] In this case saddle 19, instead of having lips 27 and 28 opposite each other, may be provided with divergent wings ending in lips which engage saddles 12, 13 of the enclosure and at the same time support connectors 20, 21.

[0080] Also, if the requirement for a leaktight electrical connection is not required and supports 3 of the conducting bars have no insulating plastics sheet 4, the two shells 44, 45 (Figure 2) which form the connectors may be without resilient seals 58, 59 and can be simply joined together by a snap connection with teeth 49, 50 engaging corresponding eyes 51, 52, 53 without it being necessary to weld the overlapping edges of the shells together.

[0081] Thus different application requirements can be satisfied using the same basic modular structure with substantial savings in manufacturing processes and consumption materials.

Claims

1. Electrical butt joint for prefabricated lengths (1, 69) of electrical ducting, in which lengths a metal enclosure (2, 70) houses at least one support (3) of insulating material having a plurality of rectilinear slots, each housing a conducting bar, the extremities of said at least one support (3) being spaced apart by said enclosure, **characterised in that** it comprises:

- a metal saddle (19) which can be inserted axially to half its length in the extremity of the en-

closure (2) of a first prefabricated length (1) and with its other half in the extremity of the enclosure (70) of a second prefabricated length (69) abutting the first, said saddle (19) extending as two side members (25, 26), and

- at least one electrical connector (20, 21) fixed in a median position on one of said side members (20, 21), said connector (20, 21) being in the form of a sleeve which is fitted onto the extremity of said at least one support (3) of the two abutting lengths (1, 69), said saddle being provided with openings (33, 34, 35, 36, 37) for mechanical attachment thereof to the enclosures of said first and second trunk by means of screws and/or rivets.

2. Electrical joint according to claim 1, comprising a pair of identical electrical connectors (20, 21) each attached to one of said side members (25, 26) and within the same.

3. Electrical joint according to claim 1 or 2 in which said connector or connectors (20, 21) are provided, within the sleeve, with resilient seals (58, 59) which ensure that said sleeve is leaktightly connected to the extremities of the supports (3) inserted therein.

4. Electrical joint according to any one of the preceding claims in which said connector or connectors have ribs (40) on their outer walls which find a housing in corresponding openings (39) in said saddle (19) for accurate positioning of said connectors relative to said saddle, said saddle being provided with means (41, 42) for snap attachment of said connectors to said saddle.

5. Electrical joint according to any one of the preceding claims in which said saddle (19) has means (24, 29, 30, 31, 32) for taking up play in at least one direction transverse to the direction of insertion when the saddle is inserted.

6. Electrical joint according to any one of the preceding claims in which said connector or connectors have wings (54, 55, 56, 57) of wedge-shaped cross-section extending from the opposite openings of the sleeve to guide insertion of the extremity of supports (3) into said sleeve.

7. Electrical joint according to any one of the preceding claims preassembled in a length of ducting (1).

Amended claims in accordance with Rule 137(2) EPC.

1. Electrical butt joint for prefabricated lengths (1, 69) of electrical ducting, in which lengths a metal

enclosure (2, 70) houses at least one support (3) of insulating material having a plurality of rectilinear slots, each housing a conducting bar, the extremities of said at least one support (3) being spaced apart by said enclosure, said butt joint comprising

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- a metal saddle (19) which can be inserted axially to half its length in the extremity of the enclosure (2) of a first prefabricated length (1) and with its other half in the extremity of the enclosure (70) of a second prefabricated length (69) abutting the first, said saddle (19) extending as two side members (25, 26),

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- at least one electrical connector (20, 21) fixed in a median position on one of said side members (20, 21), **characterised in that** said saddle is provided with openings (33, 34, 35, 36, 37) for mechanical attachment thereof to the enclosures of said first and second length by means of screws and/or rivets and **in that** said connector (20, 21) is in the form of a sleeve which is fitted onto the extremity of said at least one support (3) of the two abutting lengths (1, 69).

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2. Electrical joint according to claim 1, comprising a pair of identical electrical connectors (20, 21) each attached to one of said side members (25, 26) and within the same.

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3. Electrical joint according to claim 1 or 2 in which said connector or connectors (20, 21) are provided, within the sleeve, with resilient seals (58, 59) which ensure that said sleeve is leaktightly connected to the extremities of the supports (3) inserted therein.

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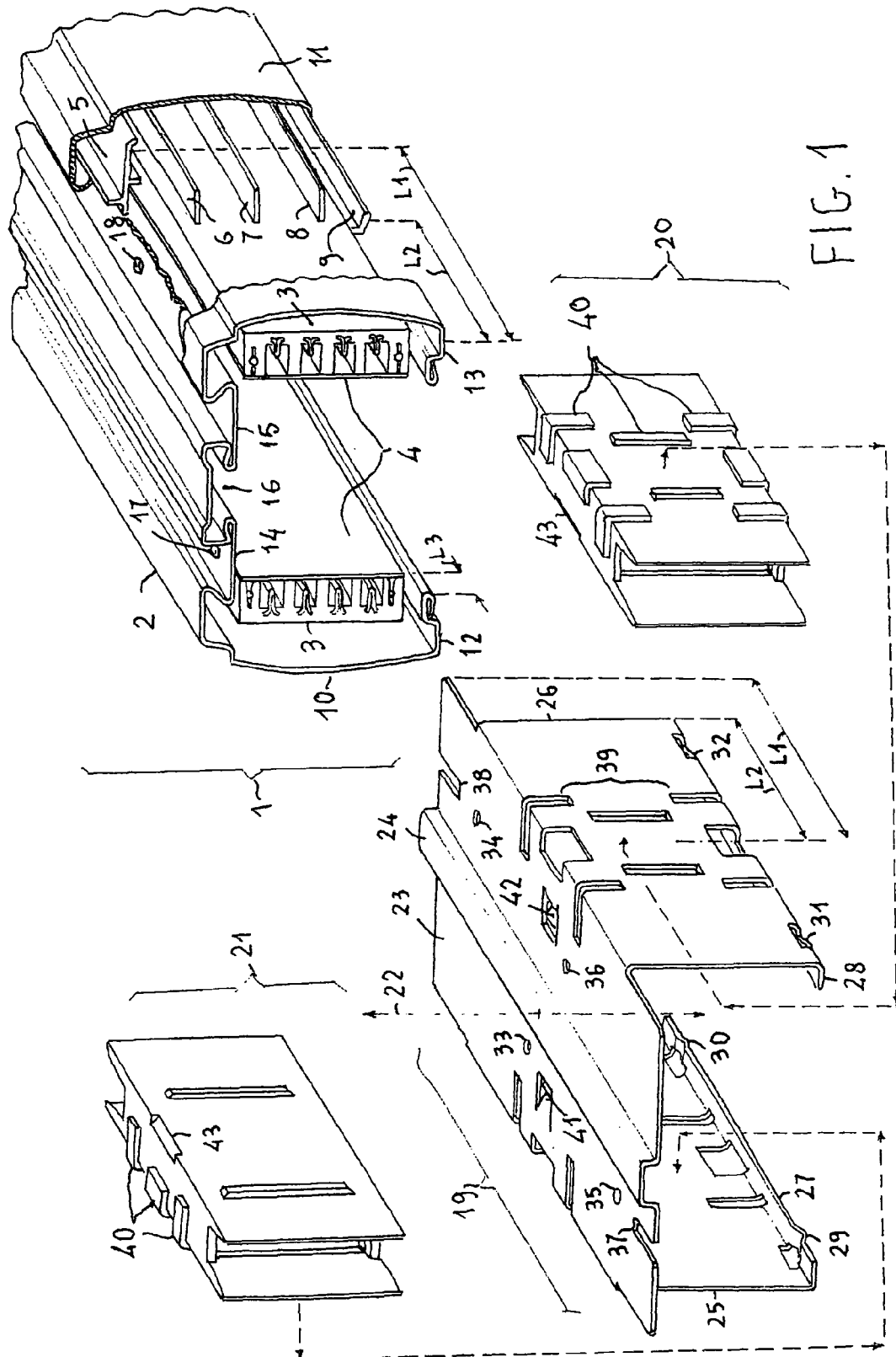
4. Electrical joint according to any one of the preceding claims in which said connector or connectors have ribs (40) on their outer walls which find a housing in

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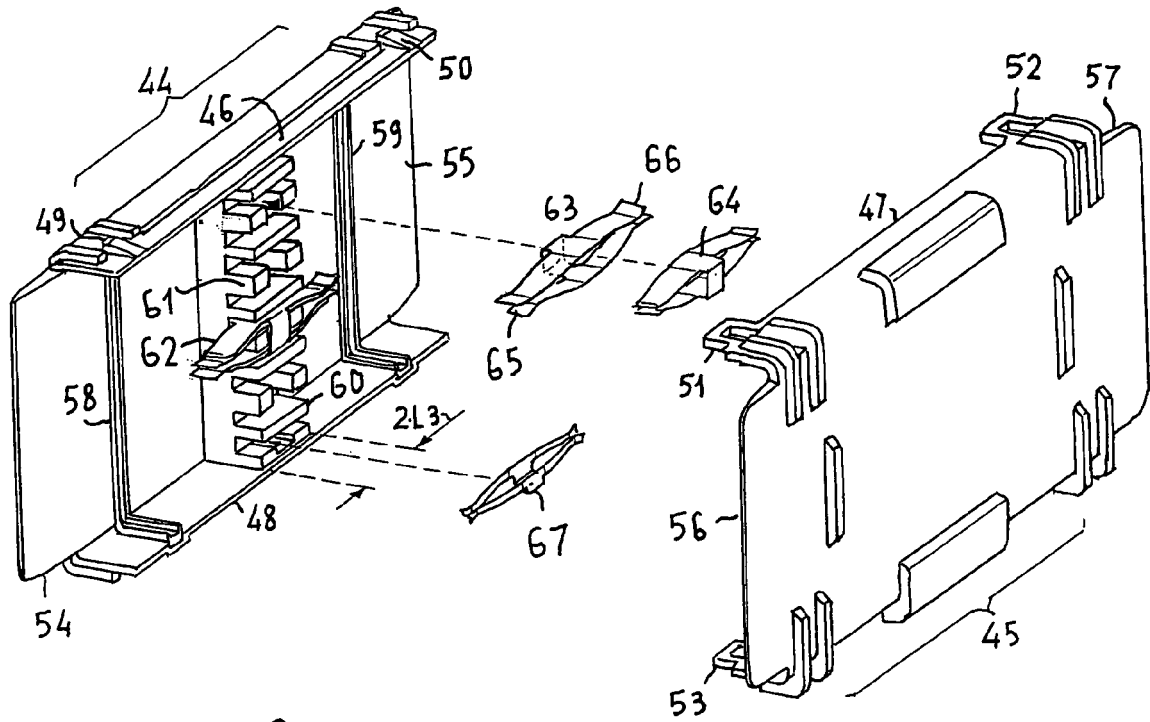


FIG. 2

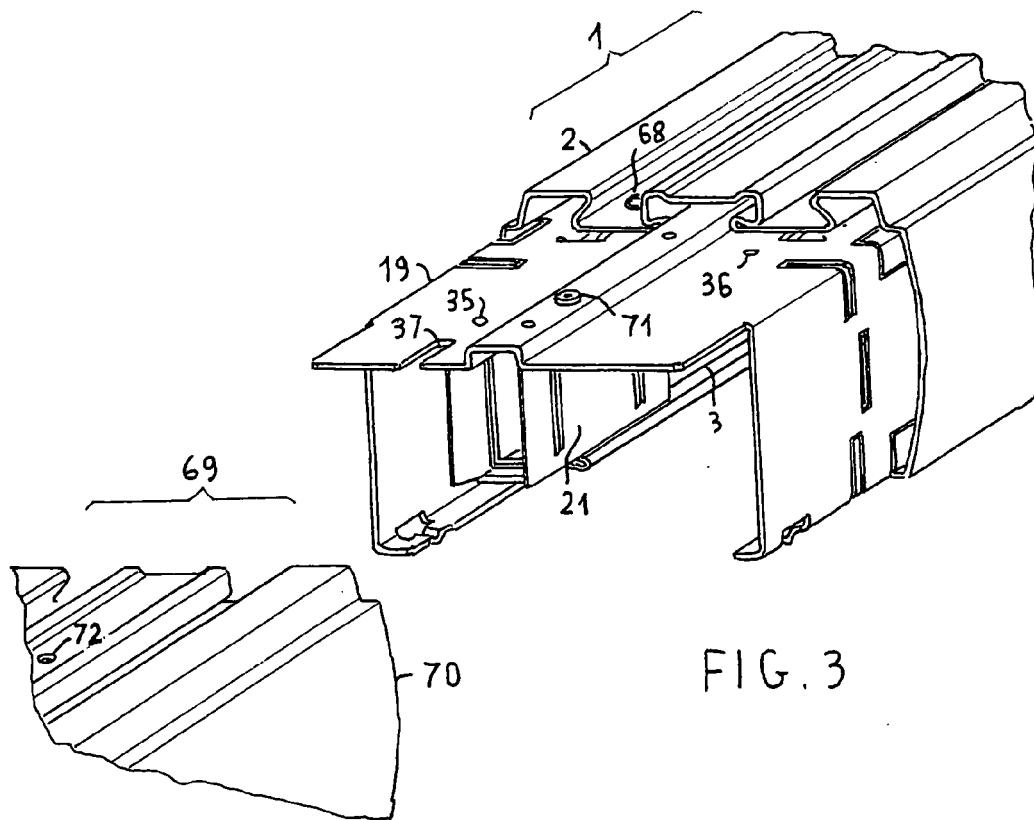


FIG. 3



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 42 5067

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 26 June 2007	Examiner Arenz, Rainer
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 07 42 5067

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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