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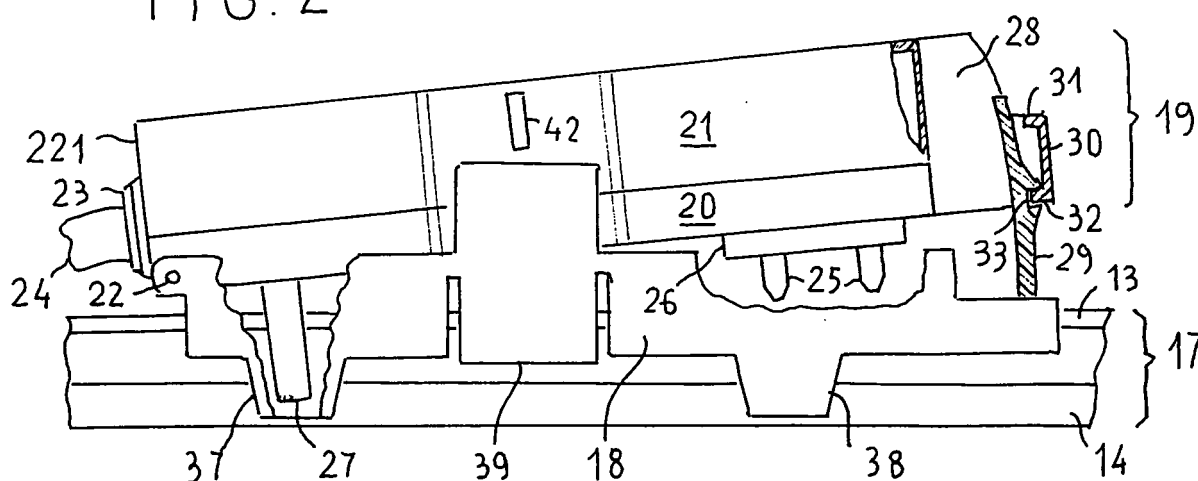
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(54) **Leaktight plug for electrical connection to a bus duct**

(57) Leaktight plug for electrical connection to a bus duct (17) in which an insulating body (1) houses in a plurality of slots (2, 3, 4, 5) which are hermetically sealed over their entire length by an insulating sheet (10) a corresponding plurality of conducting bars (6, 7, 8, 9), comprising a supporting member (18) and a plug body (19) hinged to the supporting member to adopt a disconnected operating position and an electrically connected operating position, the supporting member (18) being provided with attachment means (39) which can be operated

manually for attachment and detachment to/from the bus duct only if the plug body is in the disconnected operating position, the plug body being provided with contact clamps (25) which in the connected operating position enter into contact with the conducting bars (6, 7, 8, 9) after having perforated the insulating sheet (10), the contact clamps (25) being surrounded by a seal (26) which in the electrically connected operating position ensures a leaktight connection between the plug body and the bus duct.

FIG. 2



Description

[0001] This invention relates to a leaktight electrical plug for electrical connection to a bus duct, which is itself leaktight.

[0002] It is known that prefabricated conduit members, currently referred to as bus ducts, for the distribution of electrical power within buildings, in particular for industrial use or for offices, shops, shopping malls and the like, consist of members in standardised lengths, for example 1, 2, 3 metres, which are designed to be connected at their extremities in order to achieve the longitudinal length required for each specific application.

[0003] Electrical connections to power user equipment may be made at any point along their length.

[0004] These prefabricated members must satisfy many requirements: in addition to the ability to conduct high currents, of the order of tens of amperes (typically 25 to 40 A), they must ensure maximum safety during possible work subsequent to their installation, and, in many types of installation, such as for example so-called "floating" underfloor installations, or above false ceilings, and in all cases where there is the risk of the possible seepage of water, they must be impervious to liquids, that is they must be leaktight.

[0005] Although the requirement for operator working safety (or "finger test requirement") may be satisfied through relatively simple and economic means, such as are for example described in European Patent Application EP 1049227 by the same applicant, the requirement that the system should be leaktight has hitherto been satisfied through particularly complex and costly structures which make both installation and subsequent adaptation of the system, such as the creation of new off-takes, the removal of pre-existing off-takes and extension of the system, particularly difficult and laborious.

[0006] In European Patent Application EP 05425579.9, recently filed by the applicant, a prefabricated conduit member which overcomes these disadvantages and provides an extremely simple structure which can be manufactured economically in large volumes and satisfies the abovementioned requirements is proposed and described.

[0007] With this type of prefabricated member, it is however necessary to provide corresponding leaktight devices for electrical plugs through which user electrical equipment can be connected at any point along the length of the bus duct.

[0008] Plugs which can make an electrical connection at any point along the length of a bus duct are known for example from EP0015356, but these plugs are not leaktight, as neither is the bus duct.

[0009] Conversely leaktight electrical connection devices which can be connected to leaktight bus ducts only at predetermined positions along them provided for the purpose are known.

[0010] However connections can only be made through laborious operations using suitable tools and

generally require that the system be shut down.

[0011] Disconnection from the bus duct and restoration of leaktight properties at the point where a plug is removed are also laborious.

5 **[0012]** This invention overcomes these problems and provides a leaktight electrical connection plug which can be inserted at any point along the length of a bus duct of the abovementioned type, through a simple two-stage operation, attachment and electrical connection respectively, without the need for any tools and without it being necessary to shut down the system.

10 **[0013]** Both the operation of insertion and that of removal can be carried out under conditions of maximum safety, without there being any possibility of accidental contact between the operator and live parts.

15 **[0014]** The modular structure of the plug also means that its components can be used to manufacture a variety of plugs capable of satisfying the greatest variety of user requirements, such as for example connection to just one or many phases of a three-phase system and/or the incorporation of protection fuses into the plug.

[0015] In accordance with the invention, these results are achieved through a plug structure as described in the appended claims.

20 **[0016]** The features and advantages of the invention will be more clearly apparent from the following description of a preferred embodiment and its variants provided with reference to the appended drawings in which:

- 30 - Figure 1 is a view in transverse cross-section of a prefabricated conduit member to which the connectors according to this invention are designed to be connected,
- 35 - Figure 2 shows diagrammatically in side view a leaktight plug according to this invention fitted onto the bus duct in a disconnected operating position,
- Figure 3 shows diagrammatically in side view the plug in Figure 2 in the electrically connected operating position,
- 40 - Figure 4 is a perspective exploded view of a preferred embodiment of the device locking the plug, in the two operating positions in the preceding figures,
- Figure 5 is a cross-section through the plug in Figure 3 according to the view BB in that figure,
- 45 - Figure 6 is a cross-section of the plug in Figure 3 according to the view CC in that figure,
- Figure 7 is an exploded perspective detailed view of the various components of the plug in the preceding figures,
- 50 - Figure 8 is an exploded perspective and magnified view of a preferred embodiment of the electrical connection clamp to the bus duct for the plug in the preceding figures,
- Figure 9 is a perspective magnified view of a box container for the clamp in Figure 8,
- 55 - Figure 10 is an exploded view in cross-section according to the view DD in Figure 9 of the box in Figure 9 and the components housed therein.

[0017] For a better understanding of the invention it is first necessary to provide a brief description of the pre-fabricated conduit member (hereinafter referred to merely as the conduit or bus duct) to which the end connector is designed to be connected.

[0018] For more detailed information concerning the conduit and the preferred embodiment thereof, reference may be made to European Patent Application EP 05425579.9 already cited.

[0019] Figure 1 shows a transverse cross-section of a bus duct. This comprises a straight extruded body 1 of insulating plastics material (PVC and the like) in which there are formed a plurality of slots, for example four, 2, 3, 4, 5, in each of which there is housed a vertical conducting bar, 6, 7, 8, 9 respectively, co-extruded with body 1.

[0020] Advantageously, bars 6-9 are obtained by bending a copper or aluminium plate in such a way as to produce an upside-down T cross-section, with lower limbs incorporated in body 1.

[0021] At the top, with reference to the view in Figure 1, the slots are enclosed by an insulating and perforatable plastics sheet 10 over the entire length of the conduit, so as to be leaktight except at the extremities of the conduit.

[0022] Although not essential, protection may be provided for sheet 10 comprising a plastics cover 11 which is snap connected to limbs 12, 13 of body 1 and is easily removable in order to permit an electrical connection to be made with bars 6-9 at any point along the length of the conduit by perforating sheet 10.

[0023] At the base body 1 is enclosed in a metal enclosure 14 obtained by bending a metal sheet with limbs 15, 16 folded inwards and leaktightly connected to the corresponding limbs of body 1.

[0024] Conveniently, in addition to providing the function of stiffening and protecting body 1, enclosure 14 also acts as an earth conductor.

[0025] In order to conclude the description of the conduit in Figure 1 it should be noted that the profile of the transverse cross-section is asymmetrical with respect to a vertical median plane A-A.

[0026] In particular it will be noted that the two limbs 15, 16 of the enclosure are different in horizontal length, greater in the case of limb 15 and less in the case of limb 16.

[0027] This arrangement serves to mechanically "polarise" the conduit continuously over its entire length, and ensures that electrical connectors, whether end or intermediate connectors, are connected to the conduit in a specific unequivocal way.

[0028] The same effect can be achieved through an enclosure 14 in which limbs 15, 16 are of the same horizontal length but are located at different heights with respect to the base of the enclosure or by providing limbs 12, 13 of different thickness for body 1, as is particularly shown in Figure 1, where limb 13 has a greater thickness than limb 12.

[0029] Clearly it is possible and may be convenient to

combine the different arrangements.

[0030] We will now consider a preferred embodiment of a leaktight plug for electrical connection to the bus duct already described, with reference to Figures 2 and 3.

5 **[0031]** Figure 2 shows diagrammatically, in side view and in partial cross-section, a leaktight plug constructed according to this invention, fitted to a bus duct 17 of the type already described, in which side limb 13 and the side of metal enclosure 14 can be seen.

10 **[0032]** The plug essentially comprises a supporting and connecting member 18, which is injection moulded of plastics material such as PVC and the like, and a plug body 19 comprising a base 20 and a removable cover 21, again moulded from insulating plastics material and connected together through an intermediate seal, which is not visible, which ensures that the connection is leaktight.

[0033] Conveniently the seal may be obtained together with base 20 through a co-moulding process.

20 **[0034]** The body, which is generically elongate in the direction of the bus duct, is hinged at one end 221 (on the left in Figure 2) on a pin 22 formed of one piece with supporting member 18 to adopt an electrically disconnected position as illustrated in Figure 2 and an electrically connected position as illustrated in Figure 3.

25 **[0035]** Body 19 is provided at its extremity 221 with a conventional perforatable leaktight opening 23 for the entry of a multipole sheathed flexible cable 24.

30 **[0036]** Within the body there are electrical connecting members, not visible, to connect the various conductors of multipole cable 24, apart from the earth conductor, to each of a plurality of contact clamps 25 which project from base 20 through convenient openings which are not leaktight.

35 **[0037]** Around these openings, which are located within a restricted area of the base, hereinafter referred to as the window, there is a moulding 26 of resilient material (synthetic rubber) which acts as a leaktight seal.

40 **[0038]** The earth conductor of the multipole electrical cable is connected electrically within body 19 to a metal contact blade 27 which projects downwards from base 20 to already come into contact with the side of metal enclosure 14 in the position illustrated in Figure 2.

45 **[0039]** The opening from which the contact blade projects is provided with a leaktight seal, which cannot be seen in Figure 2, obtained as an integral part of the leaktight seal between the base and cover, through the same co-moulding process.

50 **[0040]** At the opposite extremity from that where opening 23 is located, and outside the coupling seal between the base and cover, the cover extends to form a housing 28, open at the top and bottom, for a locking device comprising a resilient tongue 29 which is integral with supporting member 18.

55 **[0041]** Housing 28 is closed at the front by a shield 30, which is integral with the sides of the housing.

[0042] At the top and bottom the shield forms two stop teeth 31, 32 (which are preferably vertically offset in order

to prevent the occurrence of undercuts which will complicate moulding operations) which engage in a groove 33 formed in an intermediate position of the resilient tongue 29.

[0043] In Figure 2 bottom stop tooth 32 is engaged in groove 33 and stably holds the plug in the disconnected operating position.

[0044] By exerting convenient manual pressure on the end of tongue 29 towards the plug body, tooth 32 can be disengaged from groove 33.

[0045] The plug body can thus be pressed, again manually, towards supporting member 18 so that top tooth 31 snap engages groove 33, as illustrated in Figure 3, and holds the body immobilised against the supporting member in a position in which contact clamps 25 (Figure 2) penetrate the slots within the bus duct after having perforated insulating sheet 10 (Figure 1) of the bus duct and come into contact with conducting bars 6, 7, 8, 9, ensuring electrical connection.

[0046] At the same time, seal 26 (Figure 2) which surrounds clamps 25 comes into close contact with insulating sheet 10 of the bus duct, ensuring that the connection is leaktight.

[0047] This electrically connected operating position is in fact illustrated in Figure 3.

[0048] In order to return the plug body to the electrically disconnected operating position it is sufficient to press tongue 29 towards the plug body, disengaging tooth 31 from groove 33, and rotate the plug body about hinge 22 until tooth 32 engages groove 33, ensuring a stable disconnected position.

[0049] The arrangement of teeth 31, 32 and groove 33 illustrated in Figures 2 and 3 is purely by way of example and is illustrated in this way purely for clarity and simplicity of graphical representation: it is obvious that the roles of the groove and teeth 31, 32 can be changed over.

[0050] In practice, as illustrated in the partial perspective exploded view in Figure 4 it is preferable to form two pairs of recesses 43, 44 and 44, 45 on the opposite sides of tongue 29, suitably stiffened by a rib 47, and provide shield 30, which is rendered flexible by two grooves 48, 49 which separate it from the sides of housing 28 except at the top, with two side arms 50, 51 provided with teeth 52, 53 which engage in one or other of pairs of recesses 43, 44 and 44, 45.

[0051] When pressure is exerted on the bottom part of shield 30 in the direction indicated by arrow 54, teeth 52, 53 disengage from the recesses and make it possible to place the plug body in the electrically disconnected position or the electrically connected position.

[0052] Advantageously tongue 29 is provided at the top with two lateral projections 55, 56 which by interfering with arms 50, 51 of shield 30 prevent the plug body from rotating further, with respect to supporting member 18, beyond the disconnected position.

[0053] We will now consider supporting member 18 and the entire plug unit in greater detail with joint reference to Figure 3 and the cross-section in Figure 5 which

illustrate the plug in the operating position in which it is electrically connected to the bus duct.

[0054] For simplicity and clarity, only the essential members are illustrated in Figure 5: the internal components of the plug body are illustrated in greater detail in the exploded perspective view in Figure 7.

[0055] Supporting member 18 comprises a frame, generically in the shape of a saddle, which rests on top of the bus duct, straddling it.

[0056] Within one of sides 34 of the support (Figure 5) a series of teeth 35 which hook beneath limb 12 is formed at a distance from the supporting plane (consisting in sheet 10) which is equal to the thickness of limb 12 (the one of lesser thickness) of the bus duct.

[0057] It is impossible to hook these teeth onto the opposite limb 13 of the bus duct because of the latter's greater thickness.

[0058] The supporting member is then mechanically polarised to ensure an univocal position in which it is locked onto the bus duct.

[0059] In addition to this, for further safety and through the same mechanical polarising effect, the opposite side of the supporting member extends downwards in two arms 37, 38 (Figure 3) which lie alongside metal enclosure 14 when the supporting member is in the correct position and interfere with the projecting side thereof, preventing support on the bus duct if positioning is incorrect.

[0060] For permanent attachment to the bus duct the supporting member is provided with a first order lever 39, formed integrally with the supporting member, on the same side on which the two arms 37, 38 are present. The lever is hinged to the support member through a pair of relatively flexible attachments 41 (Figure 5).

[0061] The lever terminates at the bottom in an engaging tooth 40 which engages limb 13 of the bus duct.

[0062] Operation of lever 39 for attachment and release, which requires pressure to be exerted on the top of the lever in the direction indicated by arrow F (Figure 5), is only permitted if the plug body is located in the electrically disconnected operating position as illustrated in Figure 2.

[0063] Otherwise a stop 42, projecting from the side of cover 21, also illustrated in Figure 2, prevents rotation of the lever.

[0064] It is therefore clear that in order to attach the plug to the bus duct it is first of all necessary to place the plug body and the corresponding support in the relative disconnected position, if it is not already in that position, and then to press the lever upwards in such a way as to divert tooth 40 from its resting position and fit supporting member 18 onto the bus duct (in an univocal arrangement determined by the mechanical polarisation), engaging tooth 35 beneath limb 12 and then releasing lever 39.

[0065] Attachment may also be brought about by snap connection means, by exerting appropriate pressure towards the bus duct.

[0066] The operation can be performed in maximum safety because in this phase the clamps 25 (Figure 2) do

not come into contact with the conducting bars.

[0067] By then acting on the shield (in the case illustrated in Figure 4) or tongue 29 (in the case illustrated in Figures 2 and 3) it is then possible to press the plug body into the electrically connected position.

[0068] It is clear that in order to disconnect the plug from the bus duct the operations described must be performed in reverse order. First of all the plug must be placed in the disconnected position by acting on tongue 29 or shield 30.

[0069] It is then essential to act on lever 39 in order to release tooth 40 from the bus duct.

[0070] At this point the plug/supporting element unit can be removed from the bus duct under conditions of maximum safety.

[0071] The cross-section in Figure 5 also shows in detail a preferred embodiment of the connection between cover 21 and base 20 of the plug body.

[0072] Base 20, housed between two sides of supporting member 18, extends upwards to form a moulding 57 with a top housing for a co-moulded seal 58 which is leaktightly compressed by a peripheral rib of cover 21, which further extends to form a guiding skirt 59 surrounding all base 20 and all supporting member 19 apart from the area in which support member 18 extends to form lever 39.

[0073] Wholly similar is the cross-section in Figure 6, at earth contact blade 27 (Figure 2), which specifically shows contact blade 27 projecting from base 20 with a leaktight exit opening provided by seal 58 on one side of the blade and a second seal 60 formed by co-moulding together with the former on the opposite side.

[0074] Alongside contact blade 27 base 20 extends downwards into an appendage 61 which protects the blade and when the plug unit is installed on the bus duct presses the blade into contact with the side of metal enclosure 14 of the bus duct.

[0075] Appendage 61 and contact blade 27 pass freely through an opening in supporting member 18 and are in turn housed in a convenient recess in arm 37 of the supporting member.

[0076] Within the leaktight body contact blade 27 is folded back to form an electrical connection terminal 62 with an opening 63 for the passage of a tightening screw.

[0077] In addition to the parts already described, shown in greater detail, the exploded perspective view in Figure 7 shows the various components housed in the plug body.

[0078] With reference to supporting member 18 the two arms 37, 38 and lever 39 on one side of this, and the set of engaging teeth 35 on the inside of opposite side 34, will be noted.

[0079] One of pins 22 which forms an integral part of the supporting member, on which base 20 is hinged, and the locking device comprising tongue 29, in the form of construction already described with reference to Figure 4, can also be seen.

[0080] The two sides of supporting member 18 are

connected together by a supporting plane 78 which has a window 79 surrounded by a moulding 64 for the passage of contact clamps 25 and sealing moulding 26 (Figure 2).

[0081] Moulding 64, which projects towards base 20, performs the function of a mask protecting contact clamps 25 and prevents any accidental contact with these even when the plug body is in the disconnected operating position.

[0082] Outside the coupling seal between the base and cover, base 20 has two hinged arms 65 (of which only one is visible), each with a seat 66 into which one of hinge pins 22 is snap fitted, and at the opposite extremity a pair of seats 67 into which are inserted a pair of pins, not visible in the figure, formed within housing 28 of the cover in order to form a second hinge between the base and cover.

[0083] At the opposite extremity the base has two seats (only one 68 is visible) for the passage of a pair of screws 69, 70, screwing into the cover, which securely connect the base and cover together.

[0084] Removal of the screws, which is effected through convenient openings in the supporting member, of which one 80 is visible in the figure, allows the cover to rotate about the hinge (seat 67) and provide access within the plug body.

[0085] Clearly the operation is only possible if the plug is removed from the bus duct; otherwise this would prevent access to the heads of the screws to enable them to be unscrewed.

[0086] A housing, with peripheral walls 71, which receives the top part of contact blade 27 and the corresponding tightening clamp, comprising a screw/nut pair 72, 73, is formed in base 20 alongside protecting appendage 61 which receives the thrust from the contact blade.

[0087] A fuse-holder unit 74 is removably housed in base 20.

[0088] Unit 74 is correctly positioned by a pair of pins 75, 76 of base 40 which are force fitted into corresponding seats (of which one, 77, is visible) in unit 74.

[0089] With two vertical dividing walls 81, 82 the unit forms a triple housing for a corresponding triplet of fuses, only one of which 98 is shown, and for two sets of three fuse contacts, identified by references 83A, 83B respectively and each provided with a connection terminal 91.

[0090] The contact clamps are each inserted into and fixed on a short pin such as 84, 85 formed in the base of unit 74.

[0091] A triple set of housings 86, 87, 88 for a corresponding triple set of terminals of a known type, commonly known as "sleeve terminals" is formed at the extremity of the unit. One of these is illustrated in the figure and identified by reference 89.

[0092] The terminal essentially comprises a metal plate, generally of galvanically treated steel, folded so as to form a square ring, with a threaded hole for a tightening screw.

[0093] The square ring and the corresponding tighten-

ing screw are inserted into one of the housings, for example housing 86, through a bottom opening (as indicated by arrow 90) and a top opening (as indicated by arrow 91) which acts as a shoulder for the head of the screw, respectively.

[0094] The extremities of the electrical cables of the RST phase of a multipole cable inserted into the terminal body through leaktight opening 23, and the contact tongues of a triple set of clamps 83A, are inserted into the triple set of terminals located in housings 86, 87, 88.

[0095] Within the body of the plug an anchoring seat 92, which is in itself known, with screws engaging base 20, not illustrated, ensures that the extremity of the sheathed multipole cable is secured to the base.

[0096] The contact clamps of second third set 83B are each connected to a clamp 25 connecting to the bus duct through a length of preformed electrical conductor 94 electrically welded to a plate of clamps 83B on the one side and a connecting plate 95 of clamps 25 on the other.

[0097] For simplicity and clarity only one of these connections is illustrated in the figure.

[0098] Preferably contact clamps 25, which may vary in number according to requirements, may be four in number to permit electrical connection of the neutral N of the system in addition to the RST phases of a three-phase system.

[0099] Contact clamps 25 are individually contained in corresponding boxes 96 of plastics material with a bottom opening from which the arms of the clamp project.

[0100] Conveniently, for reasons which we will see below, boxes 96 are also designed to contain a sleeve terminal of the type already described.

[0101] Boxes 96 are ordinarily placed by insertion from above, into housings formed by walls 97 which extend vertically within base 20.

[0102] Clearly base 20 has convenient openings which cannot be seen in Figure 7 for the arms of contact clamps 25 to pass to the exterior in relation to these housings.

[0103] As already mentioned, these openings are all located within seal 26.

[0104] As regards cover 21, there is little to add to what has already been said with respect to the preceding figures.

[0105] It can only be pointed out that cover 21 may conveniently have openings (or even a single window) closed by a plate 99 of transparent plastics material heat-welded to the cover so that correct connection of the conductors to the phase and neutral terminals can be checked visually without the need to open the plug body (it has already been said that the connections to the bus duct can be selective).

[0106] In fact through international convention the various wires in a multipole electrical cable are identified by a different colour for the various phases, the neutral and the earth conductor.

[0107] Again with a view to maximum ease and safety of use the areas of the cover (and lever 39 of supporting member 18) on which manual pressure have to be ex-

erted can be conveniently identified by knurling, as shown in the figure, which improves the grip exerted upon them.

[0108] In addition to this, tongue 29 may bear simple markings in relief, such as "ON", "OFF", which are visible in a mutually exclusive way, explicitly indicating the operative position of the plug, those of electrical connection and disconnection respectively.

[0109] We will now consider in greater detail a preferred embodiment of the connecting clamps 25 to the bus duct and the corresponding container box 96.

[0110] Figure 8 illustrates, in a magnified exploded view, a preferred embodiment of clamps 25 intended to contact the conductive bars in the bus duct.

[0111] The clamp comprises a contact member 100, obtained by cutting from a plate of copper/brass, which may be tin or silver plated, bent to form a seat 102 which has two opposite extending pointed arms 101 which are designed to perforate plastic sheet 10 (Figure 1) and come into contact with a conducting bar of the bus duct.

[0112] The seat also extends into a connecting terminal 95, which has already been considered with reference to Figure 7.

[0113] Terminal 95 may be electrically spot welded at the extremity of a conductor or inserted into a sleeve tightening terminal.

[0114] In order to ensure adequate contact pressure on arms 101, the clamp also comprises a rider 103, of harmonic steel wire or plate, bent to form an open wing which is fitted onto seat 102, spanning it.

[0115] Rider 103 extends through two legs 104 which are located on the outer surface of arms 101, pressing them together.

[0116] The extremities of legs 104 are conveniently sharpened and extend somewhat beyond the extremities of arms 101 so as to initiate perforation of insulating sheet 10 when the plug is pressed into the electrically operating position, with greater efficiency than arms 101 which only have to widen the perforation.

[0117] In order that rider 103 should be correctly positioned on seat 102, the seat is conveniently provided with a housing recess 105 and projections 106 which are obtained by folding back two pairs of tongues which extend from the sides of the seat.

[0118] Figure 9 is a magnified perspective view of box 96 which is designed to contain a contact clamp 25 and a sleeve terminal.

[0119] Figure 10 is a median cross-section through box 96 according to the view D-D in Figure 9, and shows the electrical components housed therein.

[0120] With reference to these figures, box 96 comprises a first portion 107 forming a prism-shaped housing of rectangular cross-section which is open at the bottom and provided at the top with an opening for the passage of tightening screw 108 of a sleeve terminal 109 and with a housing for the screw head.

[0121] The bottom opening is used for inserting the body of the sleeve terminal into the housing, which ter-

minal is drawn inwards by screw 108.

[0122] A second portion 110 of box 96 forms a second housing which is open at the bottom and in communication with the first on one side.

[0123] A core 112 on which the seat of a contact clamp 25 is seated, as indicated by arrow 113, is formed in the second housing, supported by wall 111 opposite the side in communication with the first housing.

[0124] This seating operation, which is performed by automatic assembly machines, occurs before the subsequent insertion, where specified, of the sleeve terminal, which takes place in the same direction, so that connection terminal 95 of the clamp is inserted within terminal 109.

[0125] The extremity of screw 108 acts directly on terminal 95.

[0126] Screwing of screw 108 brings about tightening between terminal 95 and the bottom part of the terminal of an electrical conductor inserted therein.

[0127] Box 96, together with the electrical components assembled therein, is readily inserted into one of housings 97 formed in base 20 (Figure 7) of the plug body, where it is held through the interference between a pair of projections, one of which 114 is visible in Figure 9, formed on opposite walls of the box, and corresponding projections 115 (Figure 7) formed within the opposite walls of housings 97.

[0128] In order to enable projections 114 to rise over projections 115, securing the box in its housing with a snap fit, the walls of the box in which the said projections are formed have slots 116, 117 laterally to projections 114 which allow the part placed between the slots to behave as a leaf spring as a result of the relative resilience of the plastics material of which the box is formed.

[0129] The modular structure of the plug described satisfies the greatest variety of requirements at minimum cost.

[0130] In the case of users who do not require the protection provided by fuses it is possible to offer a plug in which the fuse-holder unit is wholly absent.

[0131] Connection of the various phases and the neutral of the multipole cable selected by the user is performed by the user by tightening the various extremities in the terminals housed in boxes 96.

[0132] These, and the corresponding plugs, may be present only in the number required, for example for connection of the neutral and one phase alone, or only the three phases, or some of these.

[0133] Obviously it will always be desirable to provide the connection between the earth conductor and the earth terminal.

[0134] In the situation where the protection provided by fuses is required, the plug may be provided with the fuse unit already installed and with the connection to the contact clamps, except the contact with the neutral, already made, as described with reference to Figure 7.

[0135] In this case the various boxes 96 (except that which contains the contact clamp with the neutral) may

only contain contact clamps 25, with some saving of components (sleeve terminals in three of boxes 96).

[0136] The preceding description only relates to a preferred embodiment but it is clear that many variants may be applied thereto.

[0137] In particular if the leaktight bus duct is not provided with an outer metal enclosure and the earth conductor is housed within it together with the voltage and mains voltage conducting bars, contact blade 27 in Figures 2, 6 and 7 may be replaced by a contact clamp which is identical or similar to those used for connection to the mains and located in the same output window 26 (Figures 2 and 7).

[0138] In this case the earth contact clamp may be conveniently located closer to the hinge on which the plug body is hinged to the supporting member relative to the other clamps so as to ensure that an earth contact precedes the mains connection in time when changing from the disconnected operating position to the electrically connected operating position (and obviously follows it when changing from the connected operating position to the disconnected operating position).

Claims

1. Leaktight plug for electrical connection to a bus duct (17), of the type in which an insulating body (1) houses a plurality of conductors (6, 7, 8, 9) in slots hermetically sealed by a sheet of insulating material (10) over their entire length, said plug being **characterised in that** it comprises:

- a supporting member (18) for support on and anchoring to said bus duct, and
- a leaktight plug body (19), except that in a window surrounded by a moulding (26), hinged to said supporting member (18) in order to take an operating position of electrical connection to the conductors of the bus duct and a disconnected operating position, said body being provided with said window from which a plurality of electrical contact clamps (25) emerge and, through said supporting member anchored to said bus duct and, for said electrically connected operating position, perforate said insulating sheet (10) and establish electrical contact with said conductors (6, 7, 8, 9), said moulding (26) of resilient material located within said window ensuring a leaktight connection between said plug body (19) and the sheet (10) of said bus duct, said body being provided with a leaktight opening (23) for the passage of a sheathed cable and being formed of a base (20) and a cover (21) leaktightly connected with an intermediate seal (53), said cover being openable only when said plug is removed from said bus duct in order to provide access to internal connection members

- (89) to said contact clamps (25) and electrical connection between said sheathed cable and said internal members,
- said supporting member (18) being provided with means (39, 40) for attachment to said bus duct, which means can be operated manually for attachment and release only if said body is in said disconnected operating position, and snap-fit securing means (29) to secure the body in one or other of said operating positions, said securing means being releasable manually. 5 10
2. Plug according to Claim 1, comprising a contact blade (27) passing leaktightly into said base (20), said blade establishing electrical contact with an external metal enclosure (14) of said bus duct in both said operating positions when said supporting member (18) is attached to said bus duct. 15
3. Plug according to Claim 1 or 2 comprising a fuse-holder unit housed in said leaktight body (20) and provided with at least one tightening terminal (89) in order to connect the extremity of a cable wire inserted into said leaktight body through said opening (23) to a fuse housed in said unit. 20 25
4. Plug according to any one of the preceding claims, in which said base (20) forms a plurality of housings (97) for a plurality of boxes (96) of insulating material removably inserted in said housings, each of said boxes being designed to contain one of said contact clamps (25) and an electrical connection terminal (108, 109). 30
5. Plug according to any one of the preceding claims in which said contact clamps (25) comprise a contact member (100) with a connection terminal and adjacent contact arms (101) and a spring rider (103) fitted onto the contact member (101) in order to press said arms against each other, said rider (103) having legs (104) which are sharpened to perforate said insulating sheet (10). 35 40
6. Plug according to any of the preceding claims, in which said supporting member (18) comprises mechanical polarisation means (37, 38) to ensure that there is an univocal attachment position to said bus duct. 45

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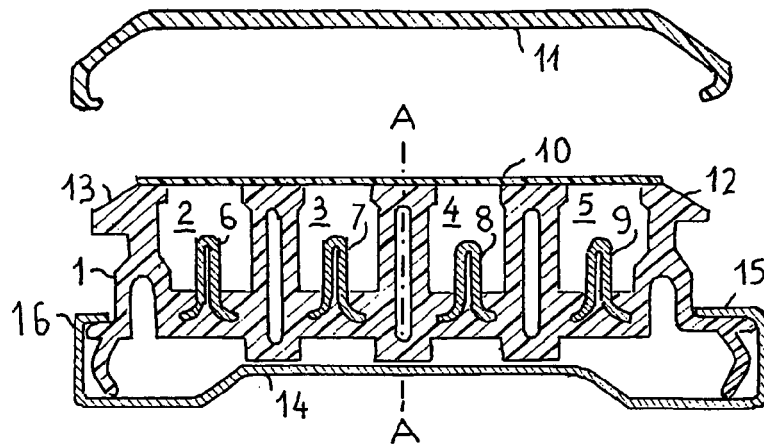


FIG. 1

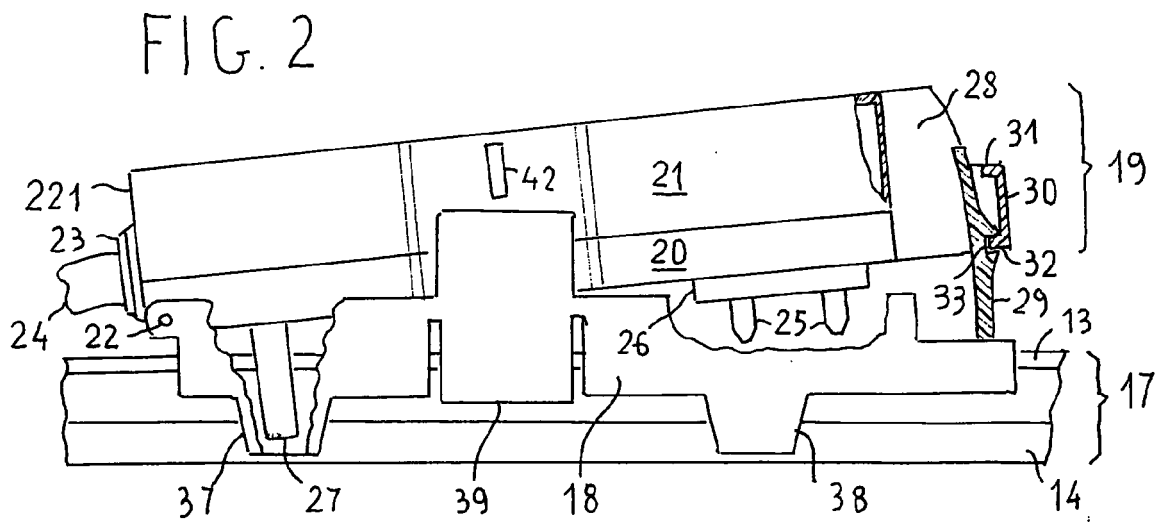
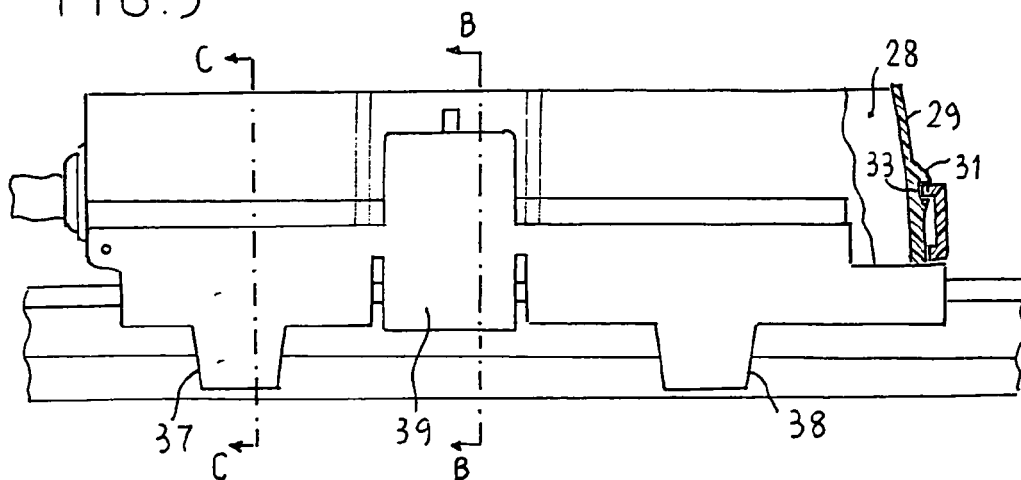
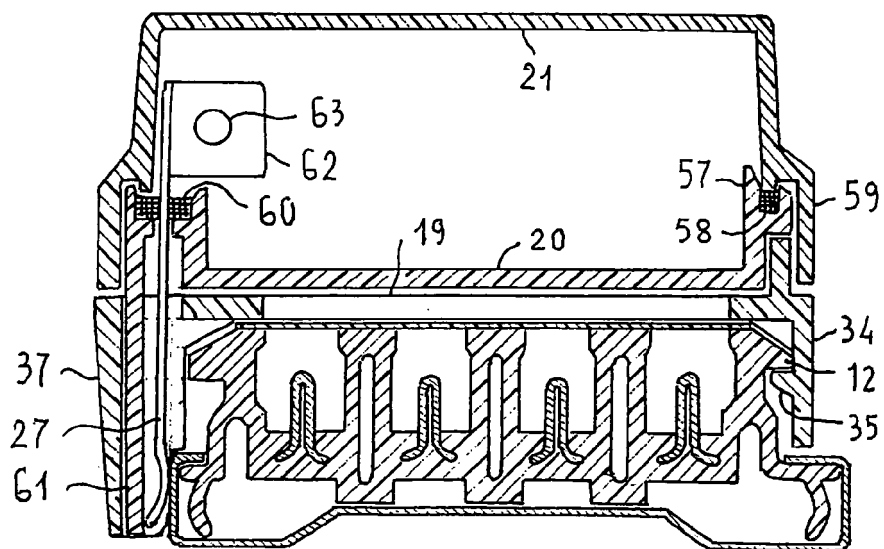
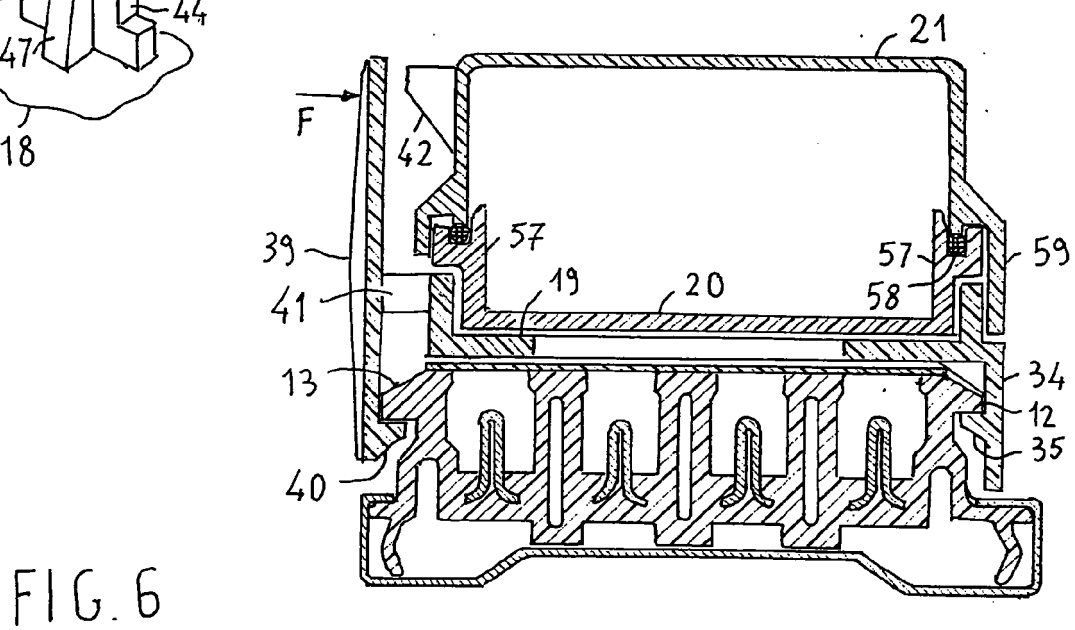
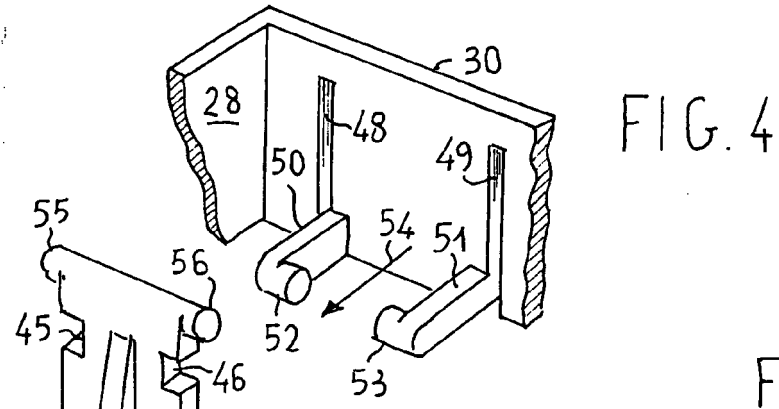


FIG. 3





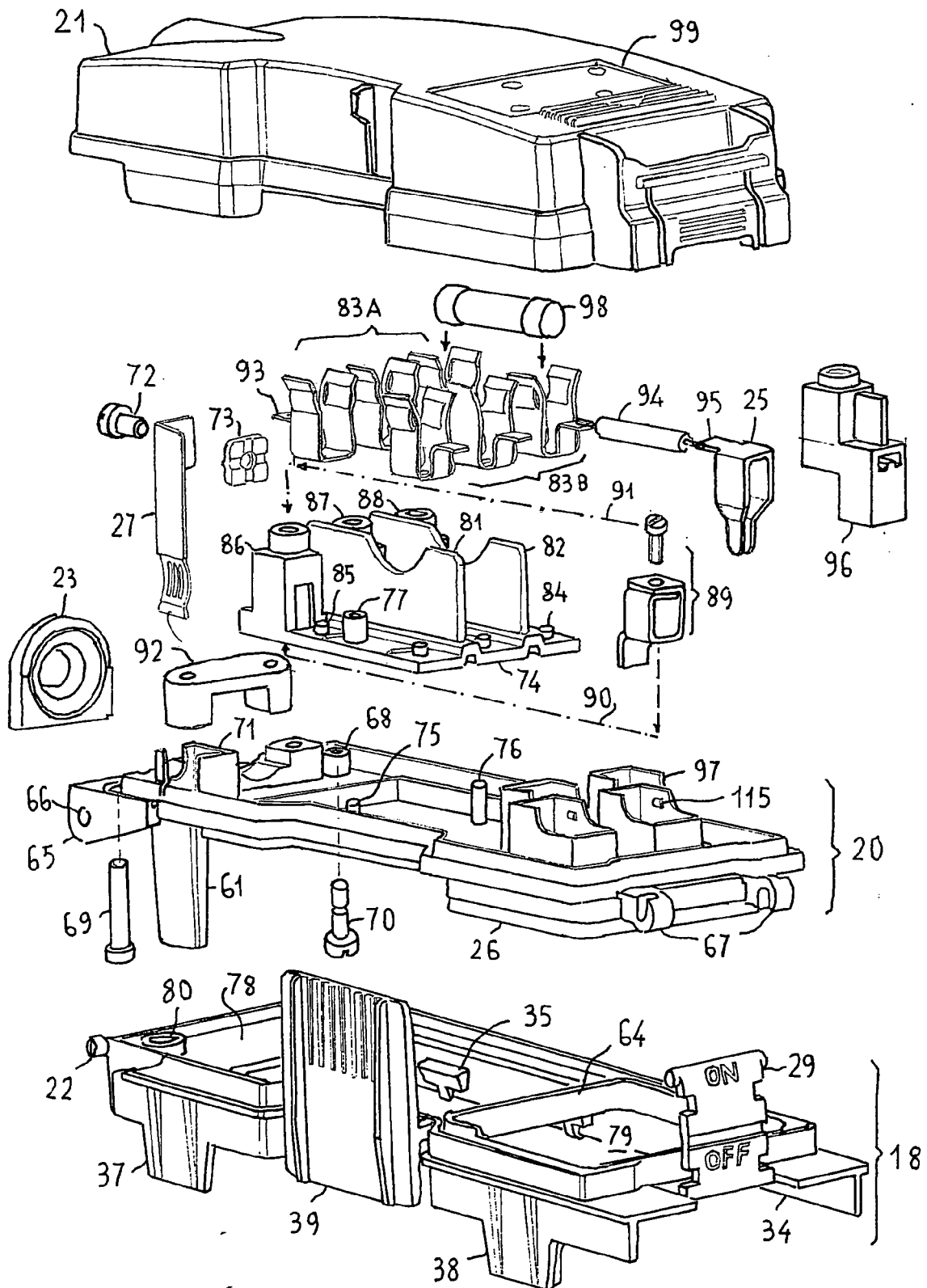


FIG. 7

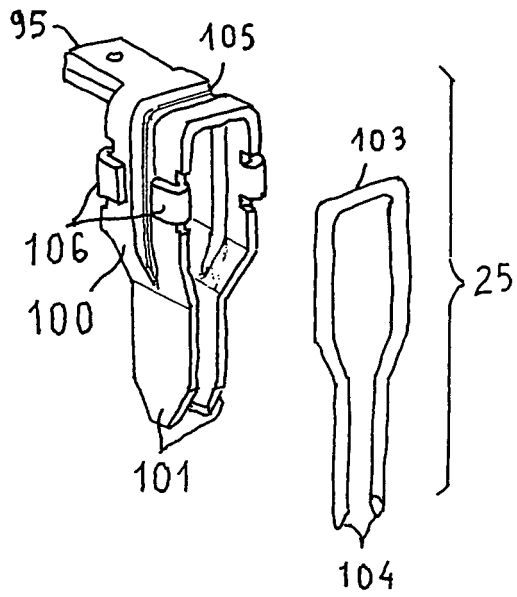


FIG. 8

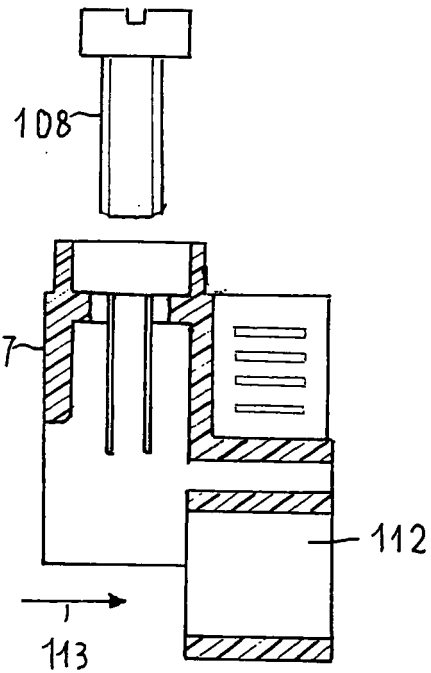
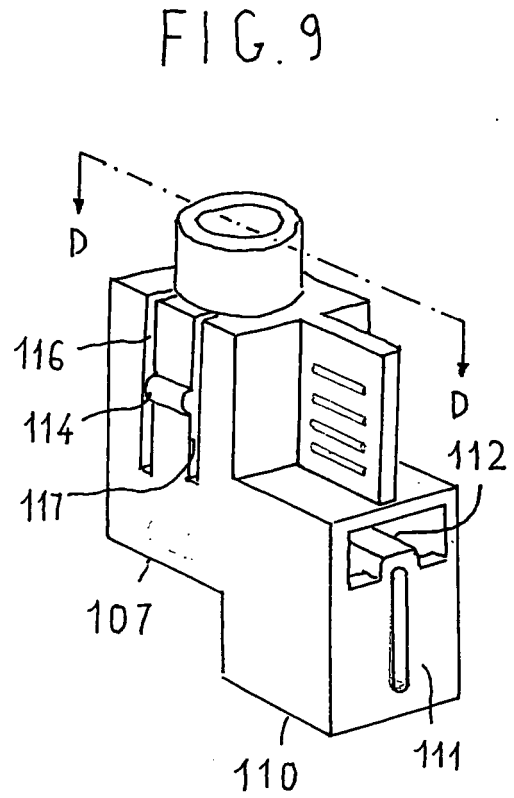


FIG. 10



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 42 5051

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 3 771 103 A (ATTEMA G,NL) 6 November 1973 (1973-11-06) * column 5, line 35 - line 45; figures 12,13 *	1	INV. F21V21/35 H01R25/14 H01R13/52
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			TECHNICAL FIELDS SEARCHED (IPC)
			H01R F21V
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 30 May 2006	Examiner Langbroek, A
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30-05-2006

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