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(54) **Leaktight electrical plug for electrical ducting**

(57) Leaktight plug for electrical connection to suspended electrical ducting in which an enclosure (1) forms a housing channel (12) open at the bottom, on at least one side of which there is located a plurality of conductors (4, 5, 6, 7, 8, 9) housed in slots (10) hermetically sealed by a sheet of perforatable insulating material (11), the plug comprising a supporting structure (16) which is inserted with a snap connection wholly within the channel (12) and a leaktight plug body (17) housed in the supporting structure (16) and hinged thereto to adopt a retracted position which will allow the supporting structure to be inserted within the channel (12) and an electrically connected position in which once the supporting structure (16) has been inserted in the channel (12) electrical contacts (19, 20) projecting from the plug body (17) in a window (21) surrounded by a resilient frame (22) perforate the insulating sheet (11) and establish electrical contact with at least one pair of conductors (4-9), movement of the plug body (17) relative to the supporting structure (16) being brought about through the action of removable means (57) which, when inserted in a wedge-shaped housing (27) in the supporting structure, using the vertex of the wedge-shaped housing as a fulcrum and engaging a sleeve (54) of one piece with the plug body (17), act as a force amplifying lever to rotate the plug body from one position to the other.

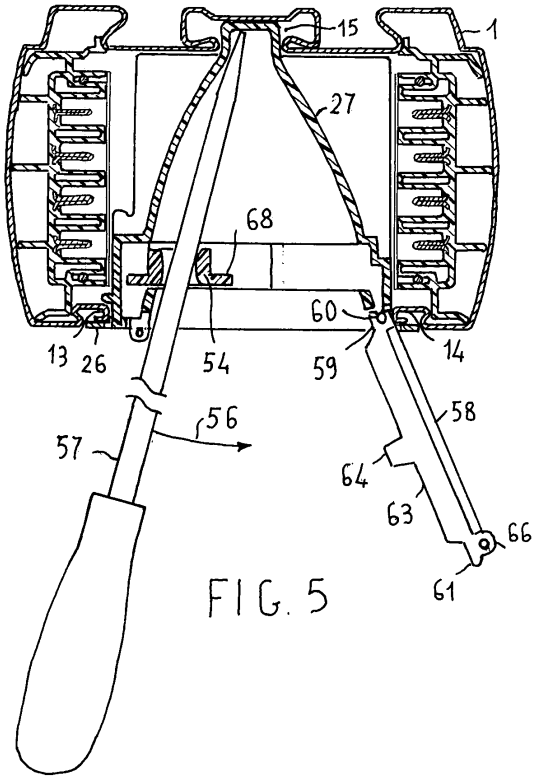

FIG. 5

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Description

[0001] This invention relates to a leaktight electrical plug for electrical ducting, in particular but not necessarily of the suspended type, with conducting bars located in leaktight slots arranged within the ducting on the sides thereof.

[0002] Suspended electrical ducting in which a straight metal enclosure which is open at the bottom houses insulating supports arranged along its sides in which a plurality of straight open slots each containing a conducting bar are formed are known, for example from EP0015365.

[0003] The slots formed in the two supports face each other at a convenient distance and form a space into which an electrical connecting plug can be inserted at any desired point along the length of the ducting. The cited document in particular describes a connecting electrical plug which when inserted into the ducting brings contact blades into contact with the conducting bars through rotation or bending of the former.

[0004] Activation takes place by means of suitable lever systems housed within the plug and integral therewith, which are nevertheless of some size, and as a result of which it projects greatly from the ducting once fitted.

[0005] Recently, as described in patent application EP1750341 prefabricated conduit members have been developed for use among other things in suspended ducting (such as described in the already cited EP0015365) in which the conducting bars are housed in slots which are hermetically sealed by an insulating plastic sheet which has to be perforated by the contact blades.

[0006] It is then necessary to exert considerable force, which the particular arrangement of the slots, facing each other over a distance of the order of a few centimetres, means that it is impossible to apply manually, even with lever systems housed within the connecting plugs.

[0007] The problem is further worsened if the connecting plugs are provided with contact clamps which must exert a suitable pressure on the sides of the conducting bars, as is required in the situation where significant currents of the order of tens of amperes, typically from 10 to 20 A, have to be transferred.

[0008] Friction between the contact clamps and the conducting bars means that considerable force has to be applied.

[0009] Another by no means secondary aspect is that in order to make a leaktight electrical connection between the plug and the conduit member the plug must be provided with a resilient seal which must be suitably compressed against the conduit member.

[0010] It is therefore necessary to provide some locking system which once electrical connection has been established ensures a rigid and non-yielding coupling which is able to apply the necessary compression.

[0011] These problems are overcome and further advantages are obtained through a leaktight electrical plug as defined by the appended claims.

[0012] Features and advantages of the invention will be more apparent from the following description of a preferred embodiment provided with reference to the appended drawings in which:

- Figure 1 is a view in transverse cross-section of electrical ducting to which the leaktight electrical plug according to this invention is intended to be connected,
- Figure 2 is a perspective overall view of a preferred embodiment of a leaktight electrical plug according to this invention, with a moving part, hereinafter defined as the plug body, in a retracted position to allow insertion into the ducting in Figure 1 or similar ducting,
- Figure 3 is an overall perspective view of the electrical plug in Figure 2, with the plug body located in the electrically connected position,
- Figure 4 is an exploded perspective view of the electrical plug in Figures 2 and 3,
- Figure 5 is a cross-sectional view, along the line A-A in Figure 4, of the electrical plug in Figures 2, 3, 4 inserted into the ducting in Figure 1, with the plug body in the retracted position,
- Figure 6 is a cross-sectional view, along the line A-A in Figure 4, of the electrical plug in Figures 2, 3, 4 inserted into the ducting in Figure 1 with the plug body in the electrically connected position,
- Figure 7 is a perspective view of the plug in the preceding figures and a fuse-holder box mechanically and electrically connected together to form a single unit,
- Figure 8 is an exploded perspective view of a group of earth contact for the electrical plug in the above figures,
- Figure 9 is an exploded perspective view of a fuse terminal and contact clamp unit for the fuse-holder box in Figure 7,
- Figure 10 is an exploded perspective view of a conducting bar terminal and contact clamp unit for the electrical plug in the above figures.

[0013] For a better understanding of the invention it is first necessary to provide a brief description of the preferred embodiment of the suspended electrical ducting to which the electrical plug is intended to be connected, with reference to Figure 1.

[0014] For more detailed information concerning the ducting in Figure 1 reference may be made to European patent application EP06425836.1 filed on the 14/12/2006.

[0015] The ducting in Figure 1 comprises a metal enclosure 1, which is open at the bottom, within which there is housed a pair of elements 2, 3, of insulating material supporting and guiding electrical conductors.

[0016] The conductors, preferably but not necessarily six in number for each element 2, 3, comprise four conducting bars 4, 5, 6, 7 for the R, S, T phases and the neutral N of a three phase system and two conductors

8, 9 for an auxiliary voltage.

[0017] The conductors are housed in rectilinear slots formed within the supporting elements and collectively identified by reference number 10.

[0018] The slots are hermetically sealed by a plastic sheet 11, which is insulating and perforatable, welded by heat/compression or extruded over the entire surface of the support onto which the slots open.

[0019] In enclosure 1, located between supporting members 2, 3 facing each other, there is formed a channel 12 for housing electrical plugs and other auxiliary elements.

[0020] Indicatively channel 12 has a depth of the order of 50 mm and a width of the order of 53 mm.

[0021] At the mouth of the channel enclosure 1 has two projections 13, 14 facing each other which act as hooking members for a lower cover panel, not illustrated, and for electrical devices, such as connecting plugs, housed within the channel.

[0022] At the top enclosure 1 is shaped to form an internal recess 15 and alongside the latter two external recesses 161, 171 having a trapezoidal cross-section into which convenient suspending stirrups may be inserted.

[0023] In order to make an electrical connection to the conductors of this type of ducting a leaktight electrical plug which is completely inserted into channel 12 and which is illustrated in the overall perspective views in Figures 2 and 3 is conveniently provided according to this invention.

[0024] The plug essentially comprises a supporting box structure 16 in which a plug body 17 is housed, hinged to structure 16.

[0025] The plug body 17 can adopt a retracted or electrically disconnected position relative to the supporting structure is housed, hinged to structure 16, as illustrated in Figure 2, and an electrically connected position, as illustrated in Figure 3.

[0026] Plug body 17 is provided on one side with a plurality of electrical contacts projecting from the side, at least two, 19, 20, or more, up to a maximum of six in the preferred embodiment, depending upon the user's requirements.

[0027] The electrical contacts are contained in a side portion 21, hereinafter referred to as the window, surrounded by a frame 22 of resilient material which makes a leaktight connection with plastic sheet 11 (Figure 1).

[0028] Box structure 16 essentially has a transverse cross-section of dimensions corresponding to those of channel 12 with an upper rib 23, and when the plug body is in the retracted position (Figure 2) it is freely and wholly inserted into channel 12 with rib 23 finding a precise housing in recess 15 in the enclosure, without electrical contacts 19, 20 interfering with the supporting and guide elements for the conducting bars.

[0029] Box structure 16 is anchored to enclosure 1 of the ducting by suitable teeth 24, 25 supported by resilient tongues formed by the lower part of a side of the box structure and although not visible in Figures 2 and 3 by similar teeth formed on the opposite side.

[0030] These teeth make a snap connection with projections 13, 14 of the enclosure so that the entire box structure 16 and plug body 17 are wholly housed within channel 12.

[0031] Once the unit has been inserted into channel 12 plug body 17 can be rotated relative to supporting structure 16 and caused to adopt the position illustrated in Figure 3 in which resilient frame 22 bears against insulating sheet 11 (Figure 1) and contact members 19, 20 come into contact with the conducting bars and establish electrical connection after perforating insulating sheet 11.

[0032] Rotation of plug body 17 relative to the supporting box structure is brought about by an ordinary device such as a screwdriver which is removably inserted into a suitable seat formed in the support and engaged with an eye or fork formed on the plug body.

[0033] The device acts as a second order lever (fulcrum-resistance-power) amplifying force.

[0034] The exploded perspective view in Figure 4 and the cross-sections in Figures 5, 6 clarify these aspects.

[0035] Figure 4 shows the different components which form a leaktight plug according to this invention in a preferred embodiment.

[0036] Box structure 16, of a plastics material such as polyamide, polypropylene or the like, containing suitable additives, for example glass fibres, comprises a rectangular platform 26 above which there is at one extremity a wedge-shaped case 27, with a base and an apex, which is internally hollow and open at the base.

[0037] At the opposite extremity the box structure is provided with a bracket 28 which connects to the apex of case 27 through rib 23.

[0038] Projecting portion 29 of bracket 28 is provided with a circular opening 30, in vertical alignment with a corresponding circular opening 31 formed in platform 26.

[0039] Relatively resilient toothed vertical tongues 32, 33, 34 providing a snap connection with projections 13, 14 of the enclosure are formed on both the long sides of the platform.

[0040] Plug body 17 comprises a box 35 and a cover 36, coupled together through an intermediate resilient seal 37, preferably but not necessarily co-moulded with one of the two components, for example, as illustrated in the figure, box 35 (and also seal 22 surrounding window 21 (Figure 2) is conveniently co-moulded with box 35).

[0041] The two components (box 35, cover 36) are locked together through a pair of teeth 38, 39 located on one side of the cover 36 which engage in corresponding seats 40, 41 formed in box 35 and through a pair of screws 140, 141 passing through cover 36 which screw into corresponding seats 42, 43 formed in box 35.

[0042] On the upper surface of box 35, close to the edge thereof, there is formed a substantially cylindrical pin 44, with suitable voids, onto which is fitted a contact member 45 in the form of a semi-cylindrical ring with bent

extremities which are housed in the voids in pin 44.

[0043] Corresponding to pin 44 cover 36 is provided with a pressure member 46 which when housed in a void in pin 42 completes its cylindrical profile pressing one of the bent extremities of contact member 45 together with a metal tongue 47 of an earth contact unit 48 which will be described below.

[0044] Pin 44, together with pressure member 46, forms a journal which is inserted into opening 30 of the supporting member and when the supporting member is inserted into channel 12 is housed in recess 15 (Figure 1) with contact member 45 in electrical contact with metal enclosure 1 of the ducting which acts as an earth conductor.

[0045] The earth connection is therefore made when the plug is inserted into the channel, before the other electrical connections are made, as the plug body passes from the retracted position to the electrically connected position.

[0046] In axial alignment with journal 44 box 35 has a circular opening 49 on its lower surface for the passage of connecting electrical cables.

[0047] Opening 49 is surrounded by a collar 50 projecting towards the exterior of the box.

[0048] Collar 50 is inserted in the manner of a journal into opening 31 on platform 26 of supporting box structure 16.

[0049] Insertion is permitted by the relative elasticity of bracket 28 and its projecting portion 29.

[0050] Opening 49 is closed off by a conventional rubber cap 51, which can be perforated in such a way as to permit the passage of a sheathed electrical cable and at the same time ensure a leaktight seal.

[0051] A similar circular opening 52 is formed through the connection of box 55 to cover 36 on the side of body 17 closest to pin 44 and opening 49.

[0052] This opening, which is also closed off by a conventional perforatable rubber cap 53 may be used as an alternative to opening 49 for the passage of a sheathed electrical cable, or, as will be seen below, for the electrical connection of an auxiliary fuse-holder box.

[0053] The sheathed cable is firmly anchored to the plug body by means of cable clamping saddle 84 with tightening screws 85, 86 which screw into corresponding seats (18, 87 or 18, 88) formed in box 35.

[0054] The saddle can adopt two positions, rotating on common seat 18, depending upon whether the sheathed connecting cable to the plug is caused to pass through opening 52 or opening 49.

[0055] The face of box 35 opposite that in which opening 52 is formed is provided externally with an annular sleeve 54 with an elongated eye opening 55.

[0056] Sleeve 54 may be replaced by a fork with two teeth between which there is a space equivalent to opening 55.

[0057] When plug body 17 is inserted into box structure 16, sleeve 54 is housed in the bottom part of case 27 provided for the purpose with an elongated opening on its inner and outer sides which allows the sleeve to move out for passage of the plug body from the retracted position (Figure 2) to the electrically connected position (Figure 3) and vice versa.

[0058] The openings also act as a guide to prevent vertical displacement of the sleeve (and the plug) as it moves outwards.

[0059] Figures 5, 6 show in cross-section along the line A-A in Figure 4, case 27, sleeve 54 and the manner in which plug body 17 is rotated from the retracted position to the electrically connected position relative to supporting structure 16 through the help of removable external means.

[0060] In both the figures the electrical plug is inserted into channel 12 of enclosure 1 with rib 23 housed in inner recess 15 of the enclosure and the edges of platform 26 adjacent to projections 13, 14 of the enclosure.

[0061] In Figure 5 the plug body is in the retracted position.

[0062] By inserting a screwdriver 57 or equivalent means into sleeve 54 and case 27 in such a way as to engage its extremity in the apex of case 27, the latter acts as a fulcrum for the lever comprising the screwdriver, and by rotating this in the direction indicated by arrow 56 sleeve 54 is moved into the position illustrated in Figure 6.

[0063] The plug body adopts the electrically connected position in this way, without stress.

[0064] An elongated cover 58 of insulating material, which closes off the lower opening of wedge-shaped case 27, is provided in order to lock the plug body in the electrically connected position (Figures 4, 5, 6).

[0065] One extremity of cover 58 has a fork 59 which makes a snap connection on a pin 60 formed in the base of case 27 and integral therewith in such a way that the cover is hinged to the box structure and can adopt an open position illustrated in Figures 5, 6 and a closed position in which a tooth 61 at the opposite extremity of cover 58 makes a snap connection with a projection 62 formed on the inside surface of resilient tongue 33 supporting a locking tooth of the box structure which is forced into the engaged position.

[0066] As an alternative, the snap connection of cover 58 in the closed position may be provided by teeth located on the side of the cover which engage the sides of case 27.

[0067] In this case extremity 61 of the cover may force resilient tongue 33 into the engaged position without the latter being necessarily provided with projection 62.

[0068] Cover 58 also has a rib 63 with a wedge-shaped projection 64 on its inner surface which when the cover is in the closed position interferes with the side of sleeve 54, or more specifically with a fin 65 on one side thereof, immobilising the plug body in the electrically connected position and forcing it in a leaktight manner against one or other of members 2, 3 supporting and guiding the conducting bars, depending upon the orientation in which the plug is inserted into the ducting.

[0069] When cover 58 is closed and the plug body is

in the retracted position, wedge-shaped projection 64, interfering with a fin 68 formed on the side of sleeve 54 opposite that where fin 65 is located, immobilises the plug body in the retracted position and ensures that the plug can be inserted into the ducting without any interference between contact members 19, 20 and one or other of the members supporting and guiding the conducting bars.

[0070] Alternatively or jointly this function of immobilising the plug body in one or other of the two positions may be brought about through a projection, which cannot be seen in the figures, formed externally on the underside of the plug body and housed in a groove 145 formed in platform 26 (Figure 4).

[0071] In a median position in groove 145 there is located a projection which is functionally equivalent to wedge-shaped projection 64 which through interfering with the corresponding projection in the plug body holds the plug body in one or other of the two positions.

[0072] The position in which the plug body is located can be checked, even when the plug is inserted in channel 12, through a window 147 made in platform 26 which displays one or other of two words, for example ON-OFF, located on the underside of the plug body, to the user depending upon the position of the plug body.

[0073] Advantageously cover 58 may be provided at the extremity at which tooth 61 is located with an eye 66 which when the cover is in the closed position fits between the corresponding pair of eyes 67 formed in a projection on the underside of platform 26. Eye 66 and pair of eyes 67 comprise a lead seal safety device, that is a seal provided by a wire inserted into the eyes and irreversibly lead sealed, opening of the cover then only being possible by breaking the seal.

[0074] It is clear, if so preferred, that eyes 67 may be made in such a way as not to project from the underside of platform 26.

[0075] Obviously, in order to remove the plug from the ducting it is necessary to carry out the abovementioned operations in the reverse order, once the seal has been removed and cover 58 has been opened the plug body is returned to the retracted position with the help of a screwdriver or equivalent means.

[0076] At this point the plug can be removed from the ducting by disconnecting teeth 24, 25 (Figure 2), again with the help of a screwdriver, and pressing on tongues 32, 33 (Figure 4).

[0077] The description of the internal components of plug body 17 may now be completed with reference to Figure 4.

[0078] Within box 35 there are formed a plurality of rectangular prismatic housings, one for each contact member.

[0079] In particular, in the preferred embodiment there is a housing 69 for earth contact unit 48 and six housings, identified by numerical references 70, 71, 72, 73, 74, 75 respectively, to each receive a containment box for a member in contact with one of the different conducting bars present in one of supporting and guide members 2, 3.

[0080] In addition to the contact member (of the clamp type for connection to bars 4, 5, 6, 7 in Figure 1, of the blade type for connection to bars 8, 9) each box contains a terminal electrically connected to the contact element for securing an end of an electrical cable. The terminal is for example of the known "locking spring" type, with release key or lever to permit insertion of the cable end.

[0081] The inner walls of housings 70-75 have a pair of opposing projecting teeth in each housing, which cannot be seen in the figure, which form a snap connection with a corresponding pair of recesses formed on the side surfaces of the various boxes, holding them in position.

[0082] The modularity of the different components makes it possible to satisfy the greatest variety of requirements which in the simplest case require the presence, in the plug body, of only two contact members for connection to one of the phases of the three phase system of conducting bars and its neutral in the plug body together with the earth contact (unit 48).

[0083] Figure 4 in fact shows two boxes 77, 76, for insertion into one of the three housings 70, 71, 72 (specifically housing 72) and housing 73 respectively.

[0084] In the most complex situation box 35 can house further contact members with corresponding boxes to make a connection to all the phases of the three phase system of conducting bars and to the pair of bars 8, 9 (Figure 1) for distribution of an auxiliary or emergency voltage.

[0085] Advantageously provision is also made for the possibility of removably housing, in plug body 17, a fuse-holder unit 78, which nests slidably on guides 79 of the box 35.

[0086] The fuse-holder unit essentially comprises a plate of insulating material supporting a pair of contact clamps 80, 81 between which a fuse is removably inserted.

[0087] A box 82 which contains a spring terminal electrically connected to clamp 81 for securing the end of an electrical cable is associated with the unit.

[0088] Clamp 80 is electrically connected through electrical spot welding carried out in the factory to a length of electrical cable 83 with an end designed for insertion and locking in box 77, the clamp of which establishes contact with one of the conducting bars of the three phase system, as the user chooses.

[0089] In order to satisfy the requirement of an application which requires connection to all the phases of a three phase system and protection of all the phases through a fuse, provision is made, as already mentioned, for the use of an auxiliary fuse-holder box, which is also leaktight, and is mechanically and electrically connected to the plug in an arrangement and with wiring preferably but not necessarily carried out in the factory and inserted into the ducting as a single whole together with the plug.

[0090] For this purpose, as illustrated in Figure 2, supporting box structure 16 is provided at the extremity op-

posite that at which case 27 is located with a pair of opposing rails 89, 90 designed to nest in the extremity of a fuse-holder box which is in turn provided with slides (one of which, 139, is partly visible in Figure 7) which nest between the rails and with resilient immobilising teeth (not visible in Figure 7) which make a snap connection with suitable recesses 91, 92 formed in box structure 16.

[0091] The assembly of the plug and the fuse-holder box joined together and aligned in the direction of housing channel 12, substantially with the same transverse dimensions as box structure 16, is shown in the perspective view in Figure 7.

[0092] The fuse-holder box comprises a shell 93 closed by a cover 94 with an intermediate resilient seal 95, preferably co-moulded with the shell.

[0093] Cover 94 is attached to the shell by means of screws.

[0094] In the same way as for plug body 17 the fuse-holder box has on its undersurface a first circular opening 96 closed off by a rubber cap 142 which can be perforated as required for the leaktight passage of a sheathed multipole electrical cable, a second circular opening 97 on the end surface opposite that which is coupled to the electrical plug, also closed off by a rubber cap 138 which can be perforated for the passage of a sheathed electrical cable, and a third circular opening 137 which faces opening 52 (Figure 4) of the plug body and which is leaktight connected thereto through a flexible rubber sleeve 98.

[0095] Within the shell there is located a fuse-holder base 102 with septa vertical relative to the base which form three housings for a set of three fuses.

[0096] Two sets of three contact clamps 99, 100 which secure the ends of the fuses are mounted on the base.

[0097] The clamps of set 99 are formed of a single piece with a set of three spring terminals housed in a set of three boxes 101 of insulating material provided with engaging teeth. The boxes nest and make a snap connection to the housings in base 102.

[0098] The three clamps of the second set 100 are connected by electrical spot welding carried out in the factory to lengths of cable collectively identified by the numerical reference 103 which enter the plug body passing through sleeve 98.

[0099] The ends of the length of cable are inserted into the spring terminals associated with the contact clamps which when the plug is inserted into the ducting connect to the conducting bars corresponding to the RST phases of the three phase system.

[0100] The multipolar cable passing through one of openings 96, 97 in the fuse-holder box is connected to the terminals associated with the set of three clamps 99 in the fuse-holder box with the wires intended for connection to the RST phases.

[0101] The other wires of the cable, passing into the plug body through sleeve 98, are connected directly to the earth terminal, to the neutral terminal, if the latter is used, and if appropriate to the two connecting terminals to the auxiliary voltage, within the plug body.

[0102] The fuse-holder box is completed with a cable clamping saddle 104, wholly similar to saddle 84 in plug body 17, and a pair of teeth located at the extremities of resilient tongues, one of which, 105, can be seen in Figure 7, formed externally on the fuse-holder box to form a snap connection with the ducting enclosure and functionally identical to tongues 32, 33 of box structure 16.

[0103] It should be noted that in order to simplify the unit comprising the plug and the fuse-holder box and make it more compact it is also possible to use opening 49 (Figure 4) to insert a sheathed multipole cable in the plug body and saddle 84 to secure the cable.

[0104] The conductors which have to be connected to the RST phases of the three phase system, via the fuses, are then transferred through sleeve 98 into the fuse-holder box in order to be inserted into the terminals present in boxes 101.

[0105] In this case openings 96, 97 in the fuse-holder box, cable securing saddle 104 and tongues, like 105, with engaging teeth, are superfluous.

[0106] The dimensions of the fuse-holder box may be reduced and its structure may be appreciably simplified with obvious advantages in terms of production costs and simplicity of installation.

[0107] The fuse-holder box then takes the form of a simple appendage to box structure 16.

[0108] For completeness, the preferred embodiment of the spring terminal with an activating key and in particular unit 48 (Figure 4) will now be described with reference to the exploded perspective view in Figure 8.

[0109] The unit comprises a box 106 of insulating plastics material closed off by a cover 107.

[0110] On the front of the box there is a first tapering opening 108 for insertion of the end of an electrical cable into the box and a second opening 109, with a T-shaped cross-section, for slidably inserting an operating wedge 110 ending externally to the box in an operating key 111 and internally extending as a relatively resilient arm terminating in an engaging tooth 112 which when the wedge is inserted in the box permanently engages a shoulder 113 in the box.

[0111] A metal spring-contact member comprising the electrical terminal is housed in the box.

[0112] The terminal is obtained from a metal sheet which is conveniently cut and folded to form a contact saddle 114 which lies adjacent to opening 108.

[0113] On one side the saddle extends as a vertical contact blade 47 (as also shown in Figure 4) which projects from the box, and on the other side as a leaf spring 115 bent with two bends 116, 117 in such a way that its extremity, which is provided with an eye 118, lies opposite opening 108, closing it off.

[0114] By exerting pressure on key 111 wedge 110 interferes with bend 116 and deflects spring 115 in such a way that eye 118 is located opposite opening 108 and allows a cable end to be inserted into saddle 114, or removed if appropriate.

[0115] When key 111 is released spring 115 tends to

resume its resting configuration and eye 118 into which the cable end has been inserted forces the end against saddle 114, ensuring an effective and reliable electrical contact.

[0116] A great variety of requirements can be satisfied by suitably shaping the spring contact member.

[0117] For example the exploded perspective view in Figure 9 shows the structure of one of contact clamps 99 (Figure 7) of the fuse-holder base, the associated spring terminal and the corresponding container box 101, which in this case is open at the bottom for insertion of the terminal.

[0118] After what has been said with reference to Figure 8, any further description of this embodiment is superfluous.

[0119] The structure of contact clamp unit 81 and the box with terminal 82 in Figure 4 is wholly similar.

[0120] It is clear that the spring terminals may be operated through a cam associated with a lever, or by the lever itself, instead of with a sliding wedge operated by a key.

[0121] For example, the exploded perspective view in Figure 10 shows in detail a preferred embodiment of the structure of a contact clamp (such as 19, 20 in Figure 2) intended for electrical connection to one of conducting bars 4, 5, 6, 7 in Figure 1, the associated spring terminal and the corresponding container box (as boxes 76, 77 in Figure 4).

[0122] The box is formed of two shells 119, 120 of plastics material, suitably shaped with teeth 121 and cooperating openings 122, 133 which allow the two shells to be snap fitted together without the need for welding or adhesive bonding, although these are possible as an alternative.

[0123] Within the two shells ribs 123 are formed for positioning a contact member, substantially comprising a metal saddle 124 which extends as two adjacent blades 125, 126 forming the contact clamp, or positioning a contact member.

[0124] Saddle 124 is in line with an opening 131 formed between the two joined shells for insertion of the end of an electrical cable into the box.

[0125] A metal rider 127 which exerts resilient compression on blades 125, 126, pressing them together, is mounted on saddle 124.

[0126] Metal rider 127 extends into a leaf spring 128 bent into two bends 129, 130 in such a way that its extremity provided with an eye 132 lies close to saddle 124 and opening 131, in-between the two.

[0127] An operating lever 134 provided with a cam 135 is hinged between the two shells 119, 120.

[0128] When lever 134 is caused to rotate in the direction indicated by arrow 136 this causes cam 135 to interfere with bend 130 of the spring and bring eye 132 into alignment with opening 131.

[0129] As in the case of Figure 8 it is then possible to insert the end of an electrical cable through opening 131 and eye 132.

[0130] Releasing the lever brings about clamping of the end against the inner surface of saddle 124 by the eye and the formation of an effective and reliable electrical contact.

[0131] The structure of the contact units which are designed to establish electrical contact with emergency conductors 8, 9 (Figure 1) is wholly similar.

[0132] In this case the contact member has a single blade instead of two opposing blades, conveniently pressed by a spring, to exert the necessary contact pressure.

[0133] The above description relates to preferred embodiment for use in particular with ducting of the type described with reference to Figure 1. It is however obvious that many variants may be made according to the shape of the ducting, the number of conducting bars, or the specific use of an earth conductor replacing a metal ducting enclosure.

Claims

1. Leaktight plug for electrical connection to an enclosed busbar, in particular suspended electrical ducting, with an enclosure (1) forming a housing channel (12) which is open beneath, and at least one side of which has a plurality of straight conductors (4, 5, 6, 7, 8, 9) housed in slots (10) hermetically sealed by a perforatable insulating sheet (11), said plug being **characterised in that** it comprises a supporting box structure (16) which is inserted through a snap connection wholly within the said channel (12) and a plug body (17) which is leaktight apart from the fact that at least one pair of electrical contacts (19, 20) projects from a window (21) surrounded by a resilient frame (22),

said body (17) being housed within the said box supporting structure (16) and hinged thereto to adopt a retracted position which permits the said box structure to be inserted into the said housing channel and an electrically connected position in which when the supporting structure is inserted in the said housing channel (12) the said electrical contacts (19, 20) perforate the said insulating sheet (11) and establish electrical contact with at least one pair of the said conductors (4, 5, 6, 7, 8, 9),

the said supporting structure (16) comprising a wedge-shaped case (27) with a base and an apex forming a housing with an opening at the base of the wedge for the insertion of removable means (57) into the said housing,

the said plug body (17) comprising engaging means (54, 55, 65, 68) housed in the base of the said case (27) and being capable of being engaged by the said removable means (57) to bring about rotation of the said plug body (17) from the said retracted position to the said electrically connected position and vice versa through the action of the said removable

means in the form of a lever.

2. Leaktight plug according to claim 1 comprising an openable cover (58) closing off said wedge-shaped case (27), said cover being provided with a wedge-shaped projection (64) which when the cover is in the closed position interferes with said engaging means (65, 68) of said plug body, locking said plug body in the electrically connected position or retracted position.

3. Leaktight plug according to claim 2 in which said cover (58) comprises an eye (66) acting together with at least one eye (67) formed in said supporting box structure (16) so that said cover (58) can be lead sealed in the closed position.

4. Leaktight plug according to any one of the preceding claims in which said plug body (17) has an opening (49) which is coaxial with the hinge axis of said plug body for the passage of a sheathed multipole electrical cable, said opening (49) being closed off by a rubber cap (51), which can be perforated as required for leaktight passage of said electrical cable.

5. Leaktight plug according to any one of the preceding claims in which said plug body (17) has a second opening (52) for the passage of a sheathed multipole electrical cable on the side opposite that on which said engaging means (54, 55) are located, said second opening (52) being closed off by a rubber cap (53) which can be perforated as required for leaktight passage of said electrical cable.

6. Leaktight plug according to claim 5, dependent upon claim 4, comprising a saddle (84) for securing multipole electrical cable which saddle can adopt two securing positions with rotation on a common seat (18) for tightening screws (85) according to whether said electrical cable passes through said first (49) or second (52) opening.

7. Leaktight plug according to any one of the preceding claims in which said electrical contacts (19, 20, 125, 126) are each housed in a box (76, 77) which can be removably inserted into one of a plurality of housings (70, 71, 72, 73, 74, 75) formed within said plug body, each of said boxes also housing a terminal (124, 128, 129, 130, 132) for securing the end of an electrical cable electrically connected to said electrical contacts.

8. Leaktight plug according to claim 7 in which said securing terminals are of the retaining spring type, the spring being operated in release by a slide key or lever (134).

9. Leaktight plug according to any one of the preceding claims, in which said plug body 17 removably houses a fuse-holder unit (78) associated with a box (82) containing a spring terminal electrically connected to or integrally formed with a fuse contact clamp (81).

10. Leaktight plug according to claim 5 in which said box structure (16) comprises nesting means (89, 90) on the surface of the extremity adjacent to said second opening (52) of the plug body for an auxiliary fuse-holder box, which is also leaktight, which is located in alignment with the box structure in the direction of the housing channel (12).

11. Auxiliary leaktight fuse-holder box for a leaktight plug according to claim 10, **characterised in that** it comprises means (139) for nesting connection with the box structure (16) of said plug and a circular opening (137) which faces the second opening (52) of said plug body and is connected thereto in a leaktight manner through a flexible sleeve (98).

12. Auxiliary leaktight fuse-holder box according to claim 11 comprising

- at least one second circular opening (96, 97) for the passage of a sheathed multipole electrical cable, said second opening being closed off by a rubber cap (138, 142) which can be perforated as required for leaktight passage of said sheathed multipole electrical cable,
- a saddle (104) for securing said multipole electrical cable, and
- teeth supported by resilient tongues (105) formed externally to said fuse-holder box for making a snap connection between said auxiliary fuse-holder box and an enclosure (1) of electrical ducting.

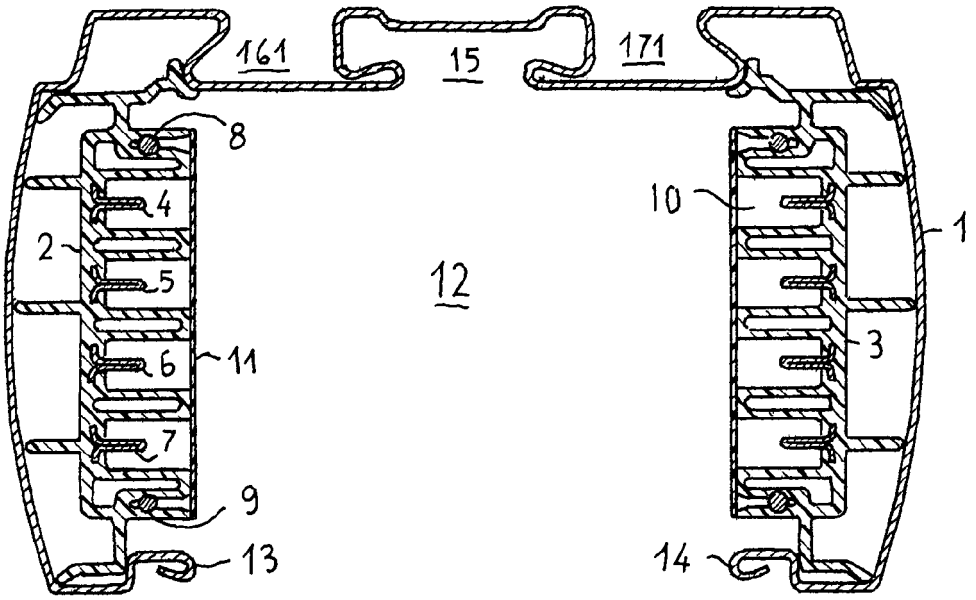


FIG. 1

FIG. 2

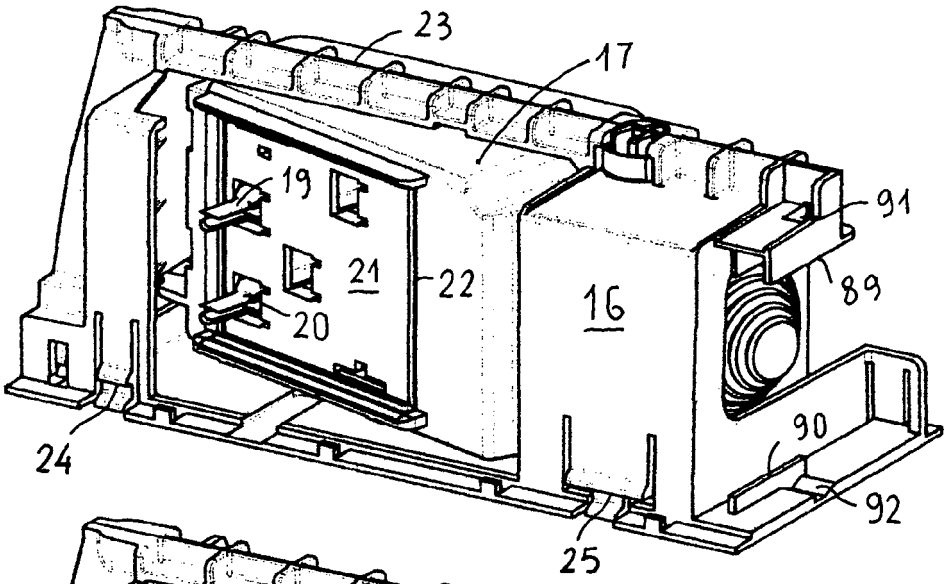
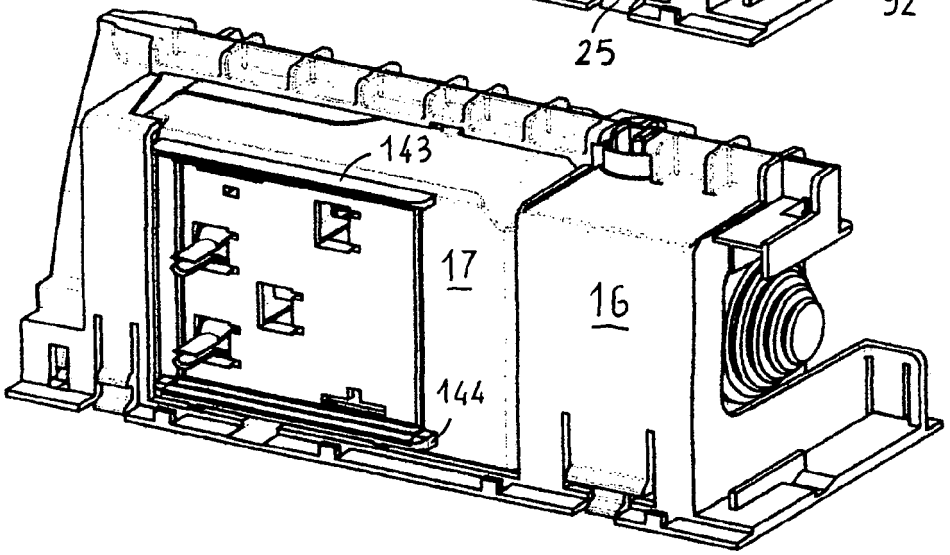


FIG. 3



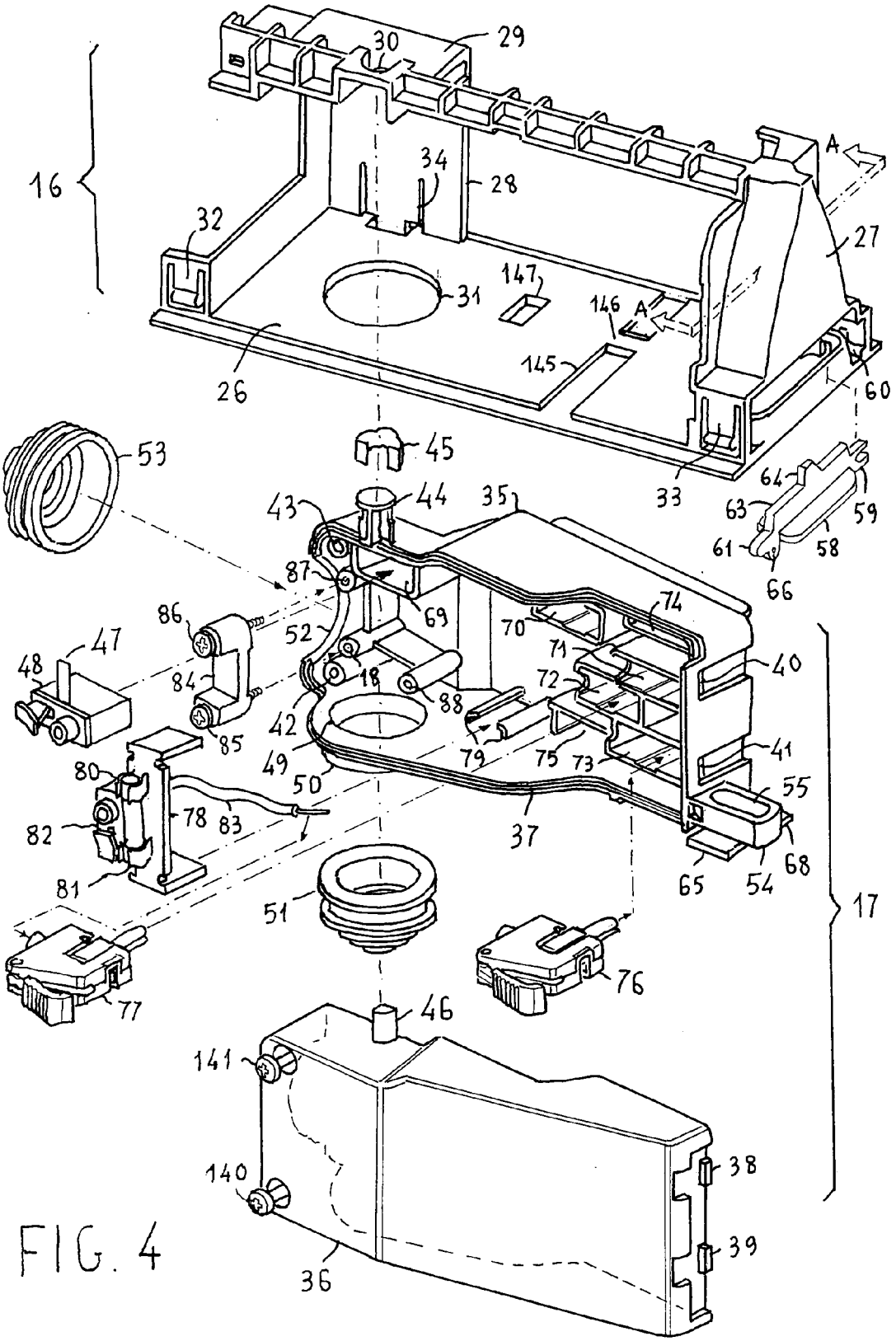

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FIG. 4

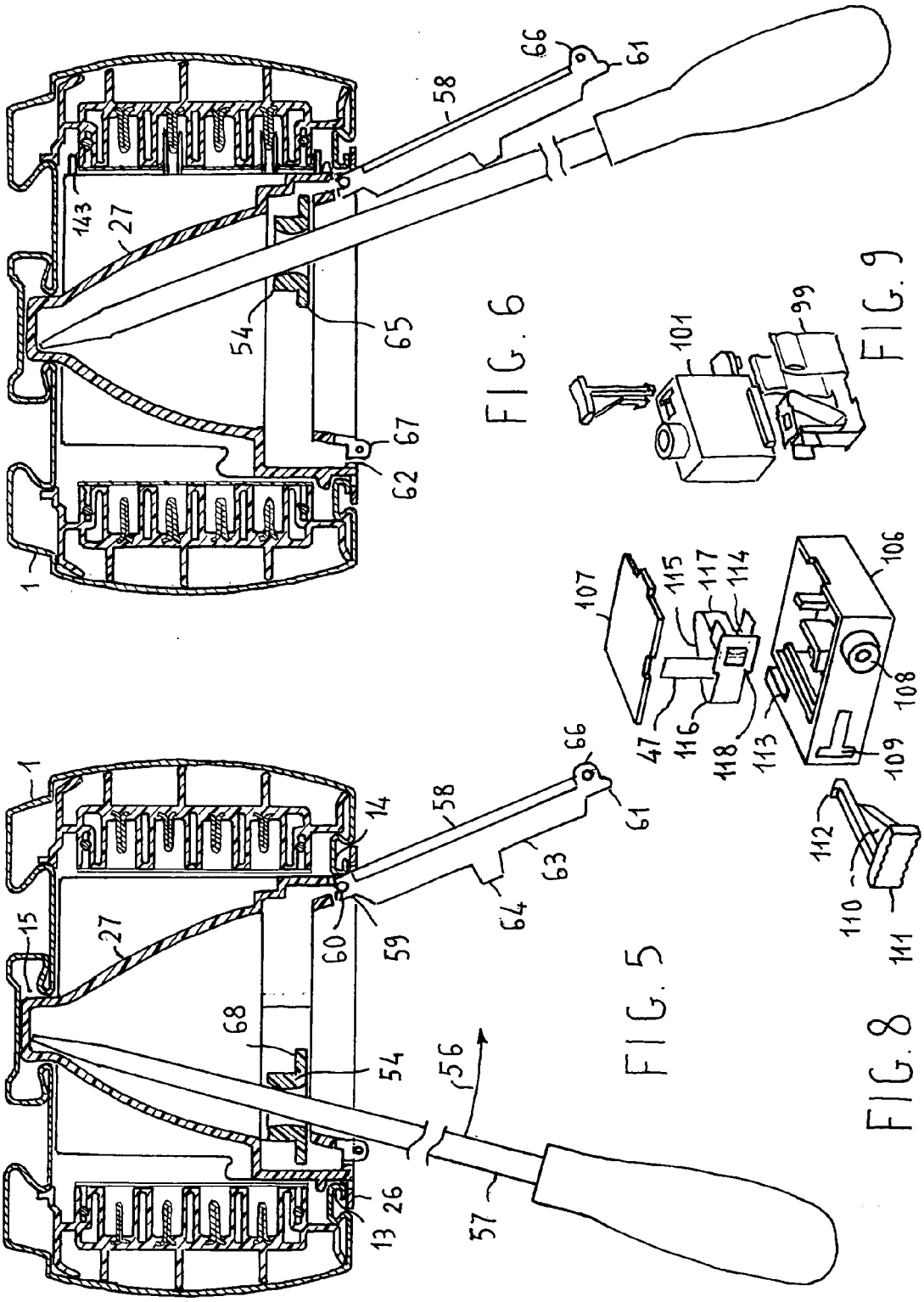
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FIG. 6
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FIG. 9
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FIG. 8
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FIG. 5

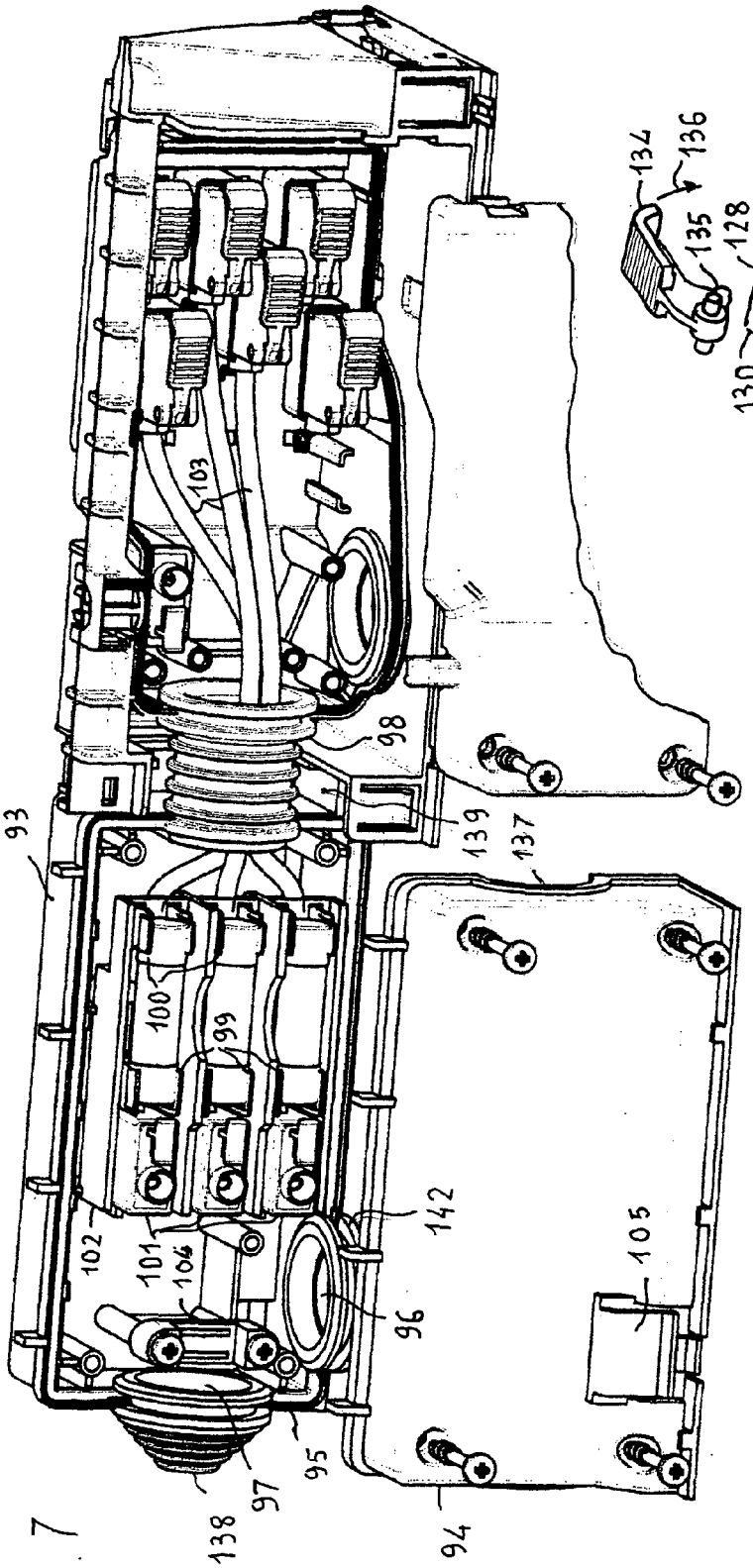
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FIG. 7

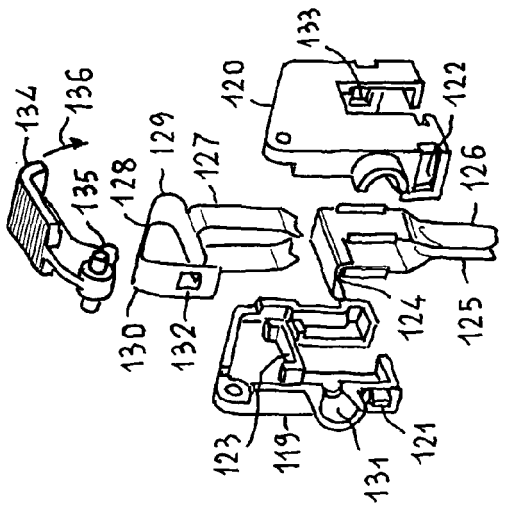
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FIG. 10

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 42 5026

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
D,A	EP 0 015 356 A1 (ZUCCHINI SPA FLLI [IT]) 17 September 1980 (1980-09-17) * the whole document * -----	1	INV. H01R25/14

TECHNICAL FIELDS SEARCHED (IPC)

H02G
H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	7 June 2007	Corrales, Daniel

CATEGORY OF CITED DOCUMENTS

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07-06-2007

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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