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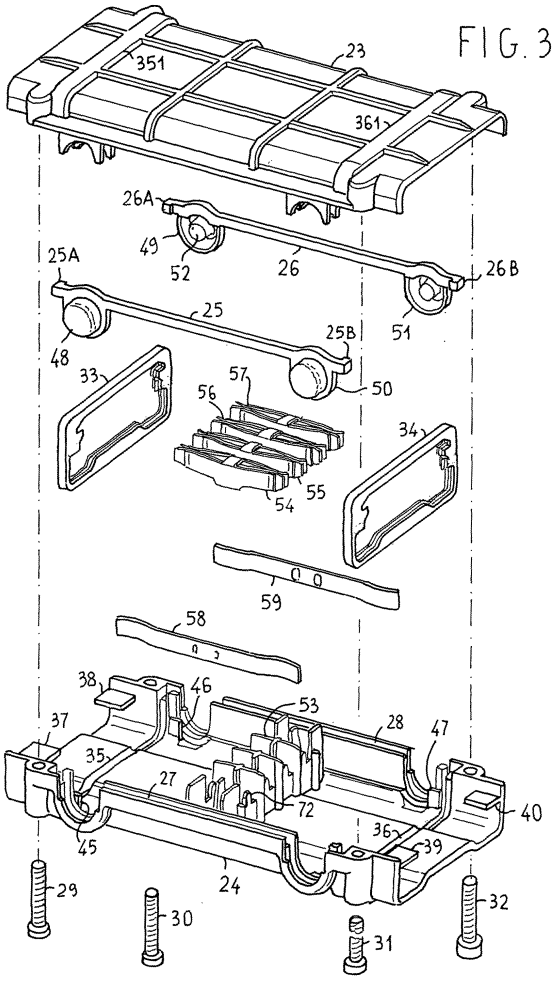
(54) Electrical end connector for a prefabricated leaktight conduit member for the distribution of electrical power

(57) Leaktight electrical end connector for a prefabricated conduit member having conducting bars (6, 7, 8, 9) housed in slots which are leaktight except at the ends of the conduit, from the sides of which there project a pair of retractable locking teeth (19) for permanent locking of the connector comprising:
a pair of shells (23, 24) of plastics material coupled together in a leaktight manner and forming an enclosure with at least one mouth, at least one seal (33) housed in the enclosure close to the mouth for leaktight coupling with the end of a first conduit member inserted therein, means (45, 46, 109, 110) within the enclosure for permanent engagement between the teeth (19) and the end of the conduit, disengaging means (48, 49, 105) to act on the locking teeth (19) or on the engaging means (109, 110) from the exterior of the enclosure to cause their disengagement, and electrical terminals (54, 55, 56, 57) housed in the enclosure for electrical connection of the conduit member to a second conduit member or to a sheathed multipole flexible electrical cable.



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Description

[0001] This invention relates to an electrical end connector for a leaktight prefabricated conduit member for the distribution of electrical power.

[0002] It is known that prefabricated conduit members, commonly known as sheathed bus bars or bus ducts, for the distribution of electrical power in buildings, in particular for industrial use or offices, shops, shopping malls and the like, consist of elements of standard lengths, for example 1, 2, 3 metres, which can be connected at their ends so as to obtain the longitudinal length required for each specific application.

[0003] Electrical connections to supply users' equipment can then be made at any point along their length.

[0004] These prefabricated members must satisfy many requirements: in addition to the ability to carry heavy currents, of the order of tens of amperes (typically from 25 to 40 A), they must ensure maximum safety in the course of any work done after they have been fitted, and in many types of installations, such as under-floor installation known as "floating" installation, within false ceilings and in all circumstances where there is the risk of possible seepage by water, they must ensure that they are impervious to liquids, that is they must be leaktight.

[0005] Although the requirement for safe working by an operator (or the "finger test requirement") may be satisfied by 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 so far been satisfied by particularly complex and costly structures which render both installation and subsequent adaptation of the system, such as the addition of new offtakes, the removal of existing offtakes 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 avoids these disadvantages and provides an extremely simple structure, which can be manufactured economically in large volumes and which satisfies the requirements already indicated, has been proposed and described.

[0007] With this type of prefabricated member it is however necessary to provide corresponding leaktight devices through which terminal electrical connections may be made between a number of conduit members so as to obtain the longitudinal lengths required, to form elbows and to connect to an electrical power source simply and reliably without the need for equipment and tools.

[0008] Leaktight terminal joints which rigidly connect two conduit members together are known for example from EP 0335756, but their installation is particularly laborious and requires that the joint be assembled on site, using appropriate tools.

[0009] In addition to this rigid connection between conduit members offers no possibility for taking up the variations in length of the conduits caused by temperature changes and incurs the risk that they might buckle.

[0010] This invention overcomes these problems and provides a leaktight terminal electrical connector which is inserted like an ordinary electrical plug into the end of a conduit member without the need for any tools.

[0011] At the same time, while allowing a certain amount of axial play to take up any thermal expansion, the connection is permanent.

[0012] The connector can nevertheless be removed by a simple and deliberate manual operation without the need for any tools (or at most, in a variant embodiment, with the help of an ordinary screwdriver), which rules out the risk of any accidental disconnection, in circumstances where modifications or maintenance of the system are required.

[0013] The modular structure of the connector also makes it possible to use most of its components, with few specific additional components, to make either electrical butt joints to connect conduit members together or to provide electrical connections for the connection of conduit members to braided, sheathed and flexible electrical cables for connection to the electrical mains or to user equipment, and using a pair of these it is also possible to make connection elbows (commonly known as flexible joints) between conduit members located at an angle to each other.

[0014] In accordance with the invention these results are achieved through a connector structure as defined in the appended claims.

[0015] The features and advantages of the invention will be more apparent from the following description of two preferred embodiments, a butt connector, and a connector providing a connection to a sheathed flexible cable respectively, and their possible variants, provided with reference to the appended drawings, in which:

- Figure 1 is a view in transverse cross-section of a prefabricated conduit member to which the connectors according to this invention are intended to be connected,
- Figure 2 is a view in transverse cross-section of a variant of the prefabricated conduit member in Figure 1,
- Figure 3 is an exploded perspective view of a preferred embodiment of a terminal connector for the butt connection of two prefabricated conduit members,
- Figure 4 is a perspective view of the connector in Figure 3, partly assembled and placed in relation to a prefabricated conduit member to which it is to be connected,
- Figure 5 is a frontal view of a preferred embodiment of a seal for the leaktight coupling of the connector in Figures 3 and 4 with a conduit member whose transverse cross-section is that illustrated in Figure 1,
- Figure 6 is a front view of a preferred embodiment of a seal for leaktight connection of the connector of

Figures 3 and 4 with a conduit member whose transverse cross-section is that illustrated in Figure 2,

- Figure 7 is a transverse cross-section along the line I-I in Figure 5 of the seals in Figures 5 and 6,
- Figure 8 is an exploded and magnified perspective view of an electrical contact terminal of the connector in Figures 3 and 4,
- Figure 9 is an exploded perspective view of a preferred embodiment of a terminal connector for connection between a prefabricated conduit member and a sheathed flexible multiple cable,
- Figure 10 is a front view of a variant embodiment of a locking device for the leaktight connector in Figures 3, 4, 9 above,
- Figure 11 is a rear view of the locking device in Figure 10,
- Figure 12 is a view of the locking device along the cross-section A-A in Figure 10,
- Figure 13 is a view of the locking device along the cross-section B-B in Figure 10,
- Figure 14 is a partial detailed view of the connector in Figures 3, 4 or 9, along the plane joinig the two shells of which it is made up, showing the locking device in Figures 10-13 in diametrical cross-section housed in its seat and located in the locking position,
- Figure 15 is a detailed view similar to that in Figure 14 which shows the locking device in Figures 10-13 in the unlocking position.

[0016] For a better understanding of the invention a brief description of the prefabricated conduit member (hereinafter referred to more simply as "conduit") to which the terminal connector is to be connected must first be provided.

[0017] For more detailed information on the conduit and a preferred embodiment thereof reference should be made to European Patent Application EP 05425579.9 already cited.

[0018] Figure 1 shows a transverse cross-section of the conduit. This includes a straight extruded body 1 of insulating plastics material (PVC and the like) in which four slots 2, 3, 4, 5 are formed, in each of which there is housed a vertical conducting bar, 6, 7, 8, 9 respectively, co-extruded with body 1.

[0019] Advantageously bars 6-9 are obtained by bending a copper or aluminium plate in such a way as to form an upside-down T cross-section with the bottom limbs incorporated in body 1.

[0020] 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, in such a way that it remains leaktight except at the ends of the conduit.

[0021] Although not essential, protection may be provided for sheet 10 by a plastics cover 11 snap connected to projections 12, 13 on body 1. the plastic cover can be easily removed in order to permit an electrical connection to be made to bars 6-9 through perforating sheet 10 at any point along the length of the conduit.

[0022] Body 1 is enclosed beneath by a metal enclosure 14 obtained by bending a metal sheet with inwardly folded limbs 15, 16 leaktightly connected to corresponding projections of body 1.

[0023] Conveniently, in addition to the functions of protecting body 1 and rendering it more rigid, enclosure 14 also functions as an earth conductor.

[0024] Between body 1 and enclosure 14 there is an intermediate space 17, which is hermetically sealed over the entire length of the conduit except at the ends where, among other things, as illustrated in Figure 4, there is a pair of opposite openings (of which only one, 18, is visible) made on the sides of the enclosure.

[0025] These openings are used for the passage of a pair of locking teeth (of which only one 19 is visible) projecting from the sides of the enclosure.

[0026] The locking teeth constitute the ends of resilient arms (of plastics material) which are of one piece with a supporting plug 20 (Figure 4) which closes off the end of the intermediate space, but in a manner which is permeable.

[0027] Clearly spacer ribs (21, 22) illustrated in Figure 1, between body 1 and metal enclosure 14, extend over the entire length of the conduit except at the ends, where they are removed in the course of the manufacturing process to allow resilient arms terminating in the locking teeth to be housed in the intermediate space and the corresponding supporting plug 20 to be irreversibly attached to enclosure 14 as explained in greater detail in the cited patent application.

[0028] The function of the locking teeth is to permanently secure end-member devices such as hermetically sealed plugs or the electrical connectors according to this invention, mounted on ends of the conduit, to the ends of the conduit.

[0029] 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.

[0030] In particular it will be noted that the two limbs 15, 16 of the enclosure extend horizontally by different amounts, greater in the case of limb 15 and lesser in the case of limb 16.

[0031] This arrangement acts to mechanically "polarise" the conduit and ensure that the electrical connectors, whether end or intermediate connectors, are attached to the conduit in a univocal way.

[0032] As illustrated in the cross-section in Figure 2, which is similar to that in Figure 1, the same effect can be achieved with an enclosure 14 in which limbs 15, 16 extend horizontally by the same amount but are located at different heights with respect to the base of the enclosure.

[0033] Clearly combinations of the two arrangements are possible and may be convenient.

[0034] Let us now consider a preferred embodiment of the electrical connector for a butt connection between

two prefabricated conduit members with reference to Figures 3 and 4.

[0035] The connector comprises a pair of shells 23, 24 of insulating plastics material (rigid PVC and the like) which are coupled together with an intermediate seal having two members 25, 26, of rubber or another suitable elastomer, forming an enclosure which is open at the two opposite ends.

[0036] The dimensions of the openings in width and height are substantially equal to the corresponding dimensions of the conduit (indicatively a width of the order of 50-60 mm and a height of the order of 15-25 mm), in such a way that the ends of the two conduits which have to be electrically connected together can be inserted into the two openings, hereinafter also referred to as "mouths", with a minimum amount of play.

[0037] Coupling between the two shells 23, 24 with consequent tightening of the intermediate seal 25, 26 housed in a seat 27, 28 formed on the edge of one of the shells (lower shell 24 in Figure 3) is achieved by means of screws 29, 30, 31, 32 which pass freely through one, 24, of the shells and engage in corresponding seats in the other shell.

[0038] Two annular seals 33, 34, which are identical with each other, and which have a generically rectangular external profile and an internal profile which is identical to the profile of the transverse cross-section of the conduit are provided to ensure that the connection between the connector and the ends of the conduits inserted into it are leaktight.

[0039] The two seals 33, 34 are respectively housed in two seats 35, 36 formed in lower shell 24, each close to one of the two mouths of the connector and in corresponding seats, which cannot be seen in Figure 3, formed in upper shell 23, and corresponding to the bottom part of the projecting ribs 351, 361 in upper shell 23.

[0040] The two seals 33, 34 leaktightly couple with the ends 25A, 26A and 25B, 26B respectively of the two sealing members 25, 26.

[0041] Clearly the two seals 33, 34, which have an internal profile identical to the profile of the transverse cross-section of the conduits, bring about mechanical polarisation of the connector and ensure that it is connected to the ends of the conduits in only one way.

[0042] In practice, in order to avoid damaging seals 33, 34 by incorrectly forcing the connector onto the ends of the conduits, it is also convenient to polarise the body of the connector.

[0043] For this purpose two pairs of fins 37, 38 and 39, 40 which extend from the sides of the shell towards the interior of the transverse cross-section at the two mouths, of different lengths and/or arranged at different heights on the side of the socket (depending upon whether the transverse cross-section of the conduit is that shown in Figure 1 or in Figure 2, or is a combination of the two), are formed for this purpose in at least one of shells 23, 24 (lower shell 24 in Figure 3, upper shell 23 in Figure 4).

[0044] Interference between these fins 37, 38, 39, 40 and limbs 15, 16 of the conduits prevent incorrect coupling of connector 12 and protect seals 33, 34 from risk of damage.

[0045] Fins 37-40 also provide a slide guide for fitting the connector onto the conduits in the correct axial direction.

[0046] Figures 5, 6 show a preferred embodiment of seals 33, 34 respectively in greater detail, in the situation where the profile of the cross-section of the conduit is that shown in Figure 1 or in Figure 2.

[0047] This comprises a cornice 41, of relatively rigid plastics material, which acts as a supporting frame for resilient seal 42, which is of rubber or another appropriate elastomer.

[0048] Advantageously, in order to ensure better coupling between cornice 41 and resilient portion 42, cornice 41 has a T-shaped cross-section, with a limb 43 extending internally, in this case of variable length, corresponding to the internal profile of the resilient seal, and embedded therein, as shown in Figure 7.

[0049] The inner surface of the seal therefore has a projecting contact lip 44 which is designed to provide a leaktight coupling with the end of the conduit and in particular with the various components of which it is made up, such as the insulating sheet 10 closing off the conduit slots, the exposed sides of insulating body 1 and metal enclosure 14.

[0050] Another aspect will now be considered with reference to Figure 3.

[0051] In order to ensure a permanent connection between the connector and the ends of the conduits, four abutments, of which only three, 45, 46, 47, are visible, are formed in shell 24 on opposite sides of the shell and in a position inside the enclosure, relative to seats 35, 36 for seals 33, 34 respectively.

[0052] When the end of a conduit is inserted into the enclosure formed by shells 23, 24, for example via the mouth located on the left-hand side of the connector as seen in Figure 3, or again in Figure 4, locking teeth such as 19 (Figure 4), provided with an inclined entry plane 114, slide yieldably over the sides of shell 24 and abutments 45, 46 and having passed them snap open again, bearing against the abutments and ensuring a permanent connection through an interference fit therewith.

[0053] The coupling which occurs when the end of a conduit is inserted into the enclosure through the socket located on the right-hand side of the connector as seen in Figures 3 and 4 is wholly similar; the pair of abutments, only one of which, 47, is visible, engage with corresponding locking teeth on the conduit.

[0054] If the connector has to be removed from the end of one or other of the conduits it is necessary to act on the teeth, such as 19, by pressing them inwards from the enclosure and thus overcoming the interference.

[0055] For this purpose two pairs of push-buttons 48, 49 and 50, 51, housed with a peripheral portion thereof acting as a seal in a suitable seat formed in shells 23 and 24, are formed of one piece with sealing members 25, 26.

[0056] Essentially push-buttons 48-51 have the shape of small cups of diameter of the order of 10-15 mm), opening towards the interior of the enclosure and extending somewhat outside of the two shells 23, 24, being therefore accessible to be easily pressed together as pairs of push-buttons between the index finger and thumb of the hand of an operator grasping the connector in order to disconnect it from the end of a conduit.

[0057] Within each of the cups there is a central core 52 which exerts a thrust action on the corresponding locking tooth of the conduit, disengaging it from the abutment.

[0058] Conveniently a rigid insert of plastics or metal may be provided within core 52.

[0059] The need to operate jointly on both the push-buttons in a pair in order to disengage the locking devices avoids the risk of accidental disconnection of the locking devices.

[0060] We will now consider the connector in Figures 3 and 4 from the strictly electrical point of view.

[0061] Vertical dividing septa, indicated as a whole by reference 53, are formed in the central part of shell 24 when the shell is moulded, forming a plurality of housing and positioning channels for a plurality of electrical contact terminals 54, 55, 56, 57, one for each of the conducting bars 6-9 in the conduit member, and for a pair of electrical earthing contact bars 58, 59 (or also for only one of these bars).

[0062] Electrical contact bars 58, 59, of tin or silver plated copper alloy (bronze or brass), are housed internally in shell 24 adjacent to their sides and, as is more clearly visible in Figure 4, have slightly curved ends 60, 61 which come into resilient electrical contact with the sides of metal enclosure 14 of a pair of conduits inserted in the connector, exerting a suitable contact pressure thereupon.

[0063] In this way electrical continuity is obtained between the earth conductors comprising the two butt-connected enclosures 14.

[0064] Figure 8 shows a preferred structure of contact terminals 54-57 in an exploded and magnified perspective view.

[0065] Each of these comprises a conducting member of silvered copper 62 having an initially flat H-shaped profile obtained by stamping, the sides or vertical limbs of which are then folded back alongside each other to form a pair of opposing contact terminals 65, 66, each intended to receive the end of a conducting bar of two conduits inserted into the connector along the axial direction of the conduits identified by the arrows 651 and 652 in Figure 4.

[0066] In order to ensure an adequate contact pressure for terminals 65, 66, a steel spring member 67, also initially having an H-shaped profile, whose sides or vertical limbs 68, 69 when folded back alongside each other form a pair of elastic tightening terminals 70, 71, is superimposed externally on contact member 62.

[0067] Posts of plastics material, formed in shell 24 (only one of which is identified by reference number 72 for simplicity and clarity), which together with dividing septa 53 ensure that the contact terminals are correctly positioned, acting together in this with projecting members, which cannot be seen, formed within upper shell 23, are inserted into the free space between sides 63, 64 and 68, 69 of the two members, as illustrated in Figure 4.

[0068] It is worthwhile noting that the function of dividing septa 53 is not only that of ensuring correct positioning of the contact terminals; being formed of insulating material they also provide better electrical insulation between the various conductors, both in terms of the dielectric strength of the intermediate material and in terms of surface resistance of the insulating material.

[0069] They also constitute a stop ledge for the ends of the conduit inserted into the connector.

[0070] In this respect it should be noted that the distance between this stop ledge and abutments 45, 46, 47 is conveniently greater (indicatively 1 mm) than the distance between locking teeth 19 and the plane of the end of the conduits.

[0071] In this way the conduits inserted in the connector, in addition to being securely locked, have a certain amount of axial allowance relative to the connector.

[0072] This allows changes in the lengths of the conduits due to temperature changes to be recovered up.

[0073] Finally the perfect mirror-image symmetry of the connector with respect to its median section, identified by section II-II in Figure 4, should be noted.

[0074] This makes possible appreciable simplifications in manufacture.

[0075] For example electrical contact bars 58, 59, seals 33 and 34 and sealing members 25, 26 are identical to each other.

[0076] We can now consider a preferred embodiment of the leaktight end connection for connecting a prefabricated conduit member to a sheathed flexible multiple cable, with reference to Figure 9.

[0077] This connector also uses the same inventive concepts already described and to a large extent also the same components.

[0078] Like the connector in Figures 3 and 4, the connector in Figure 9 comprises a pair of shells of plastics material 73, 74 which form an elongated box body (shell 74) closed by a cover (73) with an intermediate seal 75 of rubber of other appropriate elastomer, generally having the shape of a horseshoe.

[0079] Coupling of the two shells 73, 74 and tightening of seal 75 is ensured by screws 76, 77, 78, 79 which freely pass through seats formed in one of the shells (lower shell 74 in Figure 9) and engage in corresponding seats in the other shell.

[0080] In the case of screws 79, 79, passing within the shell, the heads of the screws ensure that the through passage is leaktight. A small seal may also be provided if necessary.

[0081] At one of its ends the enclosure formed by the two shells has a mouth 80 which is identical to that of the

connector in Figures 3, 4 for insertion of the end of a prefabricated conduit member.

[0082] The leaktight connection between the end of the conduit and the connector is ensured by an annular seal 81, identical to seals 33, 34 in the connector of Figure 3 and, like these, preferably made with an external frame of rigid plastics material as already described with reference to Figures 5, 6, 7.

[0083] Seal 81 is housed in a seat 82 formed in lower shell 74 and in a corresponding seat, which cannot be seen in Figure 9, formed in the upper shell.

[0084] With seal 81 arranged as illustrated in the figure, rotated through 180° with respect to a vertical axis, the connector for coupling with one or other end of the conduit is polarised.

[0085] Again in this case it is however convenient to provide polarisation means intrinsically formed in at least one of the shells and comprising, for example, polarising tongues and guides 83, 84 in the socket of the upper shell.

[0086] In this respect it will also be observed that tongues 83, 84 may be replaced by a template of rigid plastics material having a profile identical to that of seal 81 and like that orientated in one direction or the other, located in a seat similar to seat 82, formed in the close proximity of socket 80. The template may be provided with guide tongues on both sides.

[0087] This alternative offers the advantage of avoiding the formation of undercut members in the shells (and in the connector in Figure 3), with their inherent manufacturing complications.

[0088] In the specific instance of the connector in Figure 9 it has the further advantage of avoiding having to mould the shells, such as 73, 74 or both, in different ways for coupling to one or other end of a conduit.

[0089] Also the connector in Figure 9 is provided within lower shell 74 with a pair of abutments (only one of which, 85, is visible in the figure) which act together with the immobilising teeth (such as 19 in Figure 4) of the conduit member in order to make a secure coupling with the connector.

[0090] Again in the case of the connector in Figure 9 there are a pair of rubber push-buttons 86, 87, preferably formed of one piece with seal 75, housed with their peripheral portion acting as a seal in an appropriate seat 88, 89, 90 formed in shells 73, 74.

[0091] Outside the enclosure formed by the two shells 73, 74 push-buttons 86, 87 can be used to disconnect the locking devices and remove the connector from the end of the conduit inserted into it.

[0092] There are also many identical aspects from the electrical point of view.

[0093] Vertical dividing septa, indicated as a whole by reference 91, forming a plurality of housing and positioning channels for a plurality of electrical contact terminals 92, one for each of conducting bars 6-9 in the conduit member, and for an electrical earth contact bar 96 (in this case only one), are formed within shell 74 when the shell is moulded.

[0094] Electrical contact terminals 92 are identical to those used in the connector in Figure 3 and like these are preferably made as already described with reference to Figure 8. Any further explanation is therefore superfluous.

[0095] Vertical dividing septa 91 extend towards the end of the connector opposite to mouth 80 to form a plurality of housings for a plurality of electrical contact blades 93 (one for each of contact terminals 92) and for a corresponding plurality of electrical terminals 94, of the well-known type known as "sleeve connectors", plus an additional terminal 95 of the same type into which an end tongue 97 of earth contact bar 96 is inserted.

[0096] Contact blades 93, which are obtained by stamping and bending a plate of copper or brass, are appropriately shaped to be inserted from one side into one of the contact terminals 92 and from the other side into terminals 94 with a terminal tongue.

[0097] Contact blades 93, terminal tongue 97, terminals 95 and contact terminals 92 are held in their seats by a cover 98 of suitably shaped insulating material and provided with openings 99 for tightening terminals 94, 95 with an ordinary screwdriver.

[0098] The cover may be snapped into place, force fitted or thermally welded onto dividing septa 91.

[0099] The structure of the connector is completed by members which are in themselves conventional: on end wall 100 of shell 74 opposite socket 80 there is an opening 101 for the passage of a sheathed multiple cable, not illustrated, with a corresponding leaktight sleeve, also not illustrated, which is tightened onto the connector by a ring nut 102 screwed onto the sleeve and located within the connector.

[0100] The ends of the various conducting braids of the cable are tightened in terminals 94, 95 together with the terminal tongues of the contact blades and the earth contact bar.

[0101] Finally there is a support 103 for a cable clamp, not illustrated, within shell 74, which is secured to the support, with the cable in-between, by screws engaging seats such as 104 formed in the support.

[0102] It is clear that in general it will be possible to preassemble the connection between the flexible sheathed cable and connector in the workshop or in the manufacturing centre, and check its functions in terms of both insulation and electrical conductivity and leaktightness.

[0103] In particular it is possible to preassemble and provide users with "flexible joints", that is lengths of flexible multiple cable (which may be of different lengths) terminating at the end in a pair of connectors of the type described, and with that component make connecting elbows on site, or in any event flexible connections between a pair of prefabricated conduit members located in any position with respect to each other without the help of any tool.

[0104] The above description only relates to two preferred embodiments, but it is clear that many variants in

addition to those already mentioned may be applied.

[0105] For example in the case of the connector in Figure 9, conducting member 62 (Figure 8) of contact terminals 92 and contact blade 93 which is inserted therein may be manufactured as one piece through stamping and bending.

[0106] Again in the case of the connector in Figure 9 the different blades of the multiple cable may be directly and permanently welded (electrical spot welding) to the various terminal tongues 97A and 97 of contact blades 93 and earth contact bar 96.

[0107] The ends of the blades may also be anchored by stapling, or in combination by stapling and welding.

[0108] This renders the use of terminals 94 and 95 (and cover 98) superfluous.

[0109] Another possible variant consists of providing resilient push-buttons 48, 49, 50, 51 (Figure 3) and 86, 87 (Figure 9) formed separately from seals 25, 26 (Figure 3) and 75 (Figure 9) and fitted as closing caps onto the openings formed in the sides of one of the shells (24 in Figure 3 and 74 in Figure 9).

[0110] In this case seals 25, 26, 75 and tightening screws 29-32, 76-79 may be superfluous and the leaktight coupling between the two shells 23, 24 or 73, 74 may be obtained by thermally bonding the edges in contact.

[0111] Further variants are possible and preferable for mass production.

[0112] Large volume manufacture renders the use of composite moulds for the formation of cornice 41 of seals 33, 34 (Figures 3, 4) or 81 (Figure 9) as a single piece with one or two shells 23, 24 or 73, 74, and formation of resilient seal 42 itself through an immediately subsequent moulding process, economically advantageous.

[0113] The double moulding process is commonly referred to as co-moulding.

[0114] The leaktight coupling of the two shells 23, 24 (or 73, 74 in Figure 9) is in this case preferably accomplished by thermal bonding.

[0115] In order to render the permanent coupling between the connector and the end of the conduit (or conduits) even more secure and to ensure that uncoupling takes place through the effect of a deliberate action by the operator, uncoupling may be subjected to the use of a tool, such as an ordinary screwdriver.

[0116] In this case locking push-buttons 48-51 (Figure 3) or 86, 87 (Figure 9) are each conveniently replaced by a rotating bolt locking/unlocking device such as that illustrated in Figures 10 to 13.

[0117] Making joint reference to these figures the device comprises a small cylindrical cup 105, preferably but not necessarily of rigid plastics material, with an outwardly extending lip forming a positioning flange 106 which is inserted in an appropriate seat formed in the two shells of the connector and axially securing the cup, only permitting axial rotation.

[0118] A resilient ring 107 or 0-ring acting as a leaktight seal is located on the periphery of cup 105, adjacent to flange 106.

[0119] In the case where seals 25, 26 (Figure 3) or seal 75 (Figure 9) are present, resilient ring 107 may be formed of one piece with the said seals.

[0120] The variant described is in fact suitable for use both in the case where the two shells of the connector are coupled together with an intermediate seal and in the case where they are coupled together directly by thermal bonding.

[0121] A groove 108 is formed in the base of cup 15, corresponding to the part of the device exposed to the exterior of the shells forming the connector, for insertion of the end of a screwdriver.

[0122] Two teeth 109, 110, which are radially opposite and symmetrically opposite with respect to the direction of groove 108, extend in the axial direction of the cup from flange 106.

[0123] With the cup in which groove 108 is located perpendicularly to the direction of insertion/extraction of the end of the conduit into/from the connector in an angular position, one of the teeth constitutes a bolt having a function equivalent to that of abutments 45, 46, 47 (Figure 3) and 85 (Figure 9).

[0124] With the cup in an angular position in which groove 108 lies in the direction in which the end of the conduit is inserted/extracted into/from the connector, teeth 109, 110 are located laterally with respect to the locking tooth, on the sides thereof, and allow the end of the conduit to be slid out from the connector.

[0125] Figures 14 and 15 clearly show this aspect.

[0126] In the partial detailed view in Figure 14 locking/unlocking device 105 is housed in the seat formed in the shell 24 in the locking position with groove 108 located perpendicularly to the plane of the figure and teeth 109, 110 aligned in the direction of insertion/extraction.

[0127] When the end of the conduit is inserted into the connector, in the direction indicated by arrow 111, tooth 19 (Figure 4) moves yieldably within the side of shell 24 and after passing tooth 110 snaps into the undeformed stop position.

[0128] In Figure 14 tooth 19 is shown in this position by a dashed line, as a result of which the movement of tooth 19 in the opposite direction to arrow 111 is prevented through the interference between the same and tooth/bolt 110 of the locking device.

[0129] In order to overcome this interference and permit the end of the conduit to be extracted from the connector it is sufficient to rotate the locking device through 90° (in either the clockwise or anticlockwise direction) so as to line up channel 108 with the direction of extraction.

[0130] In Figure 15 the locking device is illustrated in this position, with the bolt teeth, only one of which, 110, is visible, located laterally on the sides of locking tooth 19.

[0131] In this situation tooth 19 can move freely over flange 106 in the extraction direction indicated by arrow 112 and can continue to move yieldably over an inclined guide plane 113 formed internally on the side of shell 24.

[0132] It should in fact be noted that, unlike the em-

bodiment illustrated in Figures 3, 4 and 9, in which the pressure exerted by the push-buttons on locking tooth 19 causes it to retract resiliently, in this case tooth 19 is not forced into the retracted position by locking/unlocking device 105 but by the internal wall of shell 24, which is conveniently shaped (guide plane 113) to achieve the same effect and prevent tooth 19 interfering with seal 21 and damaging it.

[0133] As already mentioned, locking device 105 can be used in both the situation in which the shells are coupled together with an intermediate seal or that in which the shells are bonded together.

[0134] Figure 15 indicates the preferred zone in which thermal bonding may be performed, by means of dashed line 115.

[0135] Finally it should be noted that a further variant is possible: although locking may take place through the interference between tooth 19 and abutments 45, 46 (Figure 3), device 105 may have only an unlocking function.

[0136] For this purpose it is sufficient to provide two cam-profiled projections with an inclined entry plane as a replacement for teeth 109, 110, which press tooth 10 inwards when cup 105 is in an angular position and leave it in its resting position in a second position rotated through 90°.

Claims

1. Leaktight end connector for at least one prefabricated conduit member, 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, with the exception of their ends, and the insulating body is partly enclosed over its entire length by a metal enclosure (14), from the sides of which there extend retractable locking teeth (19) close to the ends, **characterised in that** it comprises:

   - a pair of shells (23, 24, 73, 74) of insulating plastics material coupled together in a leaktight manner and forming an insulating enclosure with at least one first mouth (80),
   - at least one first seal (33, 34, 81) housed in the said enclosure, close to the said first mouth (80), for leaktight coupling with the end of a first prefabricated conduit member inserted into the said enclosure through the said mouth,
   - engaging means (45, 46, 47, 85, 109, 110) in the said insulating shell, in a position which is more internal with respect to the said first seal and acting together with the said locking teeth (19) to provide permanent engagement between the said connector and the said end of the prefabricated conduit member,
   - disengaging means (48, 49, 50, 51, 86, 87, 105), which can be operated from the exterior of the said insulating enclosure, to disengage the said locking teeth (19) from the said engaging means (45, 46, 47, 85, 109, 110),
   - a plurality of electrical contact terminals (54, 55, 56, 57, 92), housed in the said enclosure, in each of which it may be inserted the end of one of the conducting bars of the said first prefabricated conduit member, and
   - at least one electrical earth contact bar (58, 59, 96) housed in the said enclosure, which comes into contact with the metal enclosure (14) of the said first prefabricated conduit member.

2. Connector according to claim 1, in which the said engaging means comprise abutments (45, 46, 47, 85) formed within the sides of one of the shells and the said disengaging means comprise at least one pair of resilient push-buttons (48, 49, 50, 51, 86, 87) located opposite each other on the opposite sides of the said insulating enclosure to press the said locking teeth (19) into a retracted position.

3. Connector according to claim 2, in which the said shells are joined together by tightening screws (29-32, 76-79) with an intermediate seal (25, 26, 75) and the said resilient push-buttons are formed of one piece with the said seal.

4. Connector according to claim 1, in which the said engaging means and the said disengaging means comprise at least one pair of cups (105) rotatably and leaktightly housed on the opposite sides of the said enclosure and provided with teeth (109, 110) which when the said cups are in an angular position act as bolts on the said locking teeth (19).

5. Connector according to claim 1, in which the said engaging means comprise abutments (45, 46, 47, 85) formed internally on the sides of one of the shells and the said disengaging means comprise at least one pair of cups (105) rotatably and leaktightly housed on the opposite sides of the said enclosure and provided with cams extending internally within the said enclosure which when the said cups are in angular position press the said locking teeth (19) into a retracted position disengaging them from the said abutments.

6. Connector according to claims 1, 2, 4, 5, in which the said shells are joined together leaktightly by thermal welding.

7. Connector according to any one of the preceding claims, for the butt connection of two prefabricated conduit members, **characterised in that** the said connector has a perfectly symmetrical structure with respect to a median transverse cross-section (II-II) and comprises

- a second seal (34) identical to the first seal (33) housed in the said enclosure in the vicinity of a second mouth opposite the said first mouth to leaktightly couple with the end of a second prefabricated conduit member inserted into the said enclosure through the said second mouth,
- engaging means (47, 109, 110) in the said insulating enclosure, in a more internal position with respect to the said second seal (34) and acting together with the locking teeth of the end of the said second prefabricated conduit member to provide permanent engagement between the said connector and the end of the said second prefabricated conduit member,
- disengaging means (50, 51, 105) which can be operated from the exterior of the said insulating enclosure to disengage the locking teeth on the end of the said second prefabricated conduit member from the said engaging means (47, 109, 110),
- the electrical contact terminals of the said plurality of terminals (54, 55, 56, 57) each comprising a conducting member (62) forming a pair of opposing contact terminals (65, 66) and a spring-loaded member (67) tightening the said terminals,
- the said earth electrical contact bar (58, 59) extending in contact with the metal enclosure (14) of the said first and second prefabricated conduit members.

8. Connector according to any one of the preceding claims 1 to 6, for the connection of a prefabricated conduit member to a sheathed flexible multi-braid cable, **characterised in that** it further comprises:

- an opening (101) formed in a wall (100) of one of the said shells (74) opposite the said first mouth (80) for insertion of the end of a sheathed cable into the said enclosure with a corresponding leaktight sleeve,
- a plurality of contact blades (93) housed in the said enclosure and each electrically connected to one of the said contact terminals (92) and the end of one of the braids of the said cable.

9. Connector according to claim 8, in which the said contact terminals (92) each comprise a conducting member (62) forming a pair of opposing contact terminals (65, 66) and a spring-loaded member (67) tightening the said terminals, the end of one of the conducting bars of the said first prefabricated conduit member being inserted into one of the said terminals and one of the blades of the said plurality of contact blades (93) being inserted into the other of the said terminals.

10. Connector according to any one of the preceding claims, in which the said first seal (33, 81) and, when present, the said second seal (34) incorporate an external cornice (41) of rigid plastics material providing a support for a resilient seal (42), the said cornice (41) and resilient seal (42) being wholly co-moulded together with one of the said shells.

Amended claims in accordance with Rule 86(2) EPC.

1. Leaktight end connector for at least one prefabricated conduit member, 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, with the exception of their ends, and the insulating body is partly enclosed over its entire length by a metal enclosure (14), from the sides of which there extend retractable locking teeth (19) close to the ends, comprising:

- a pair of shells (23, 24, 73, 74) of insulating plastics material coupled together in a leaktight manner and forming an insulating enclosure with at least one first mouth (80),
- a plurality of electrical contact terminals (54, 55, 56, 57, 92), housed in the said enclosure, in each of which it may be inserted the end of one of the conducting bars of the said first prefabricated conduit member,

characterised in that it further comprises:

- at least one first seal (33, 34, 81) housed in said enclosure, close to said first mouth (80), for leaktight coupling with the end of a first prefabricated conduit member inserted into said enclosure through said mouth,
- engaging means (45, 46, 47, 85, 109, 110) in said insulating shell, in a position which is more internal with respect to said first seal and acting together with said locking teeth (19) to provide permanent engagement between said connector and said end of the prefabricated conduit member,
- disengaging means (48, 49, 50, 51, 86, 87, 105), which can be operated from the exterior of the said insulating enclosure, to disengage the said locking teeth (19) from said engaging means (45, 46, 47, 85, 109, 110),

and

- at least one electrical earth contact bar (58, 59, 96) housed in the said enclosure, which comes into

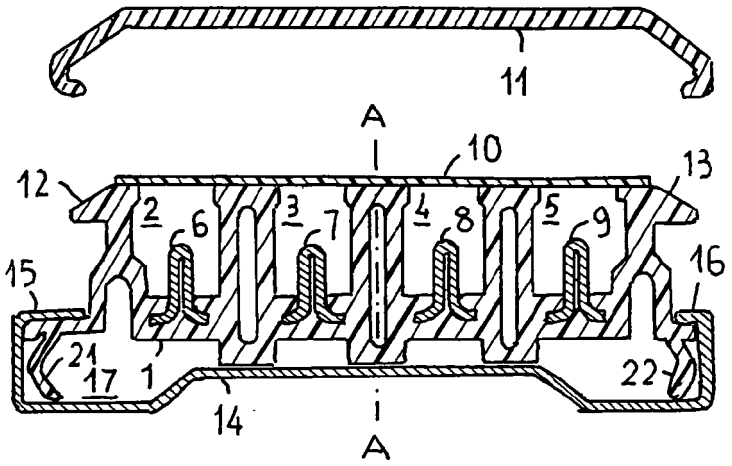

FIG. 1

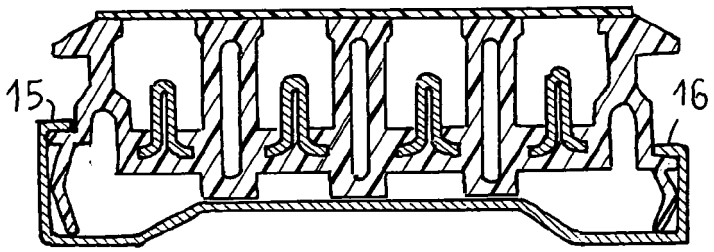

FIG. 2

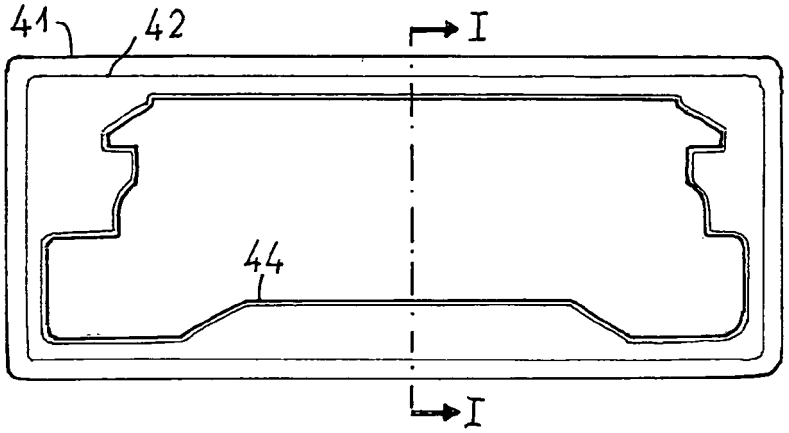

FIG. 5

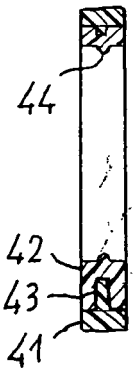

FIG. 7

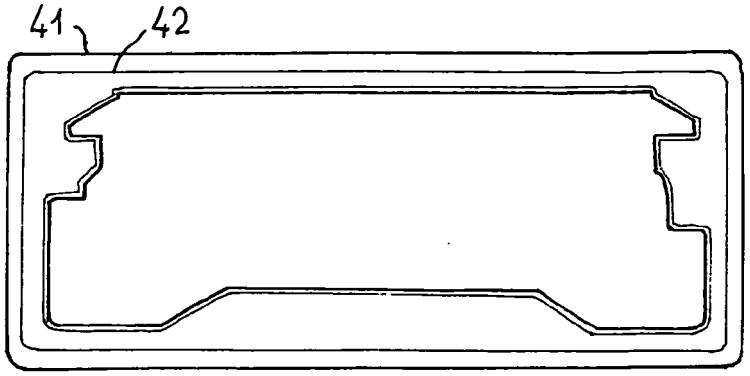

FIG. 6

FIG. 3

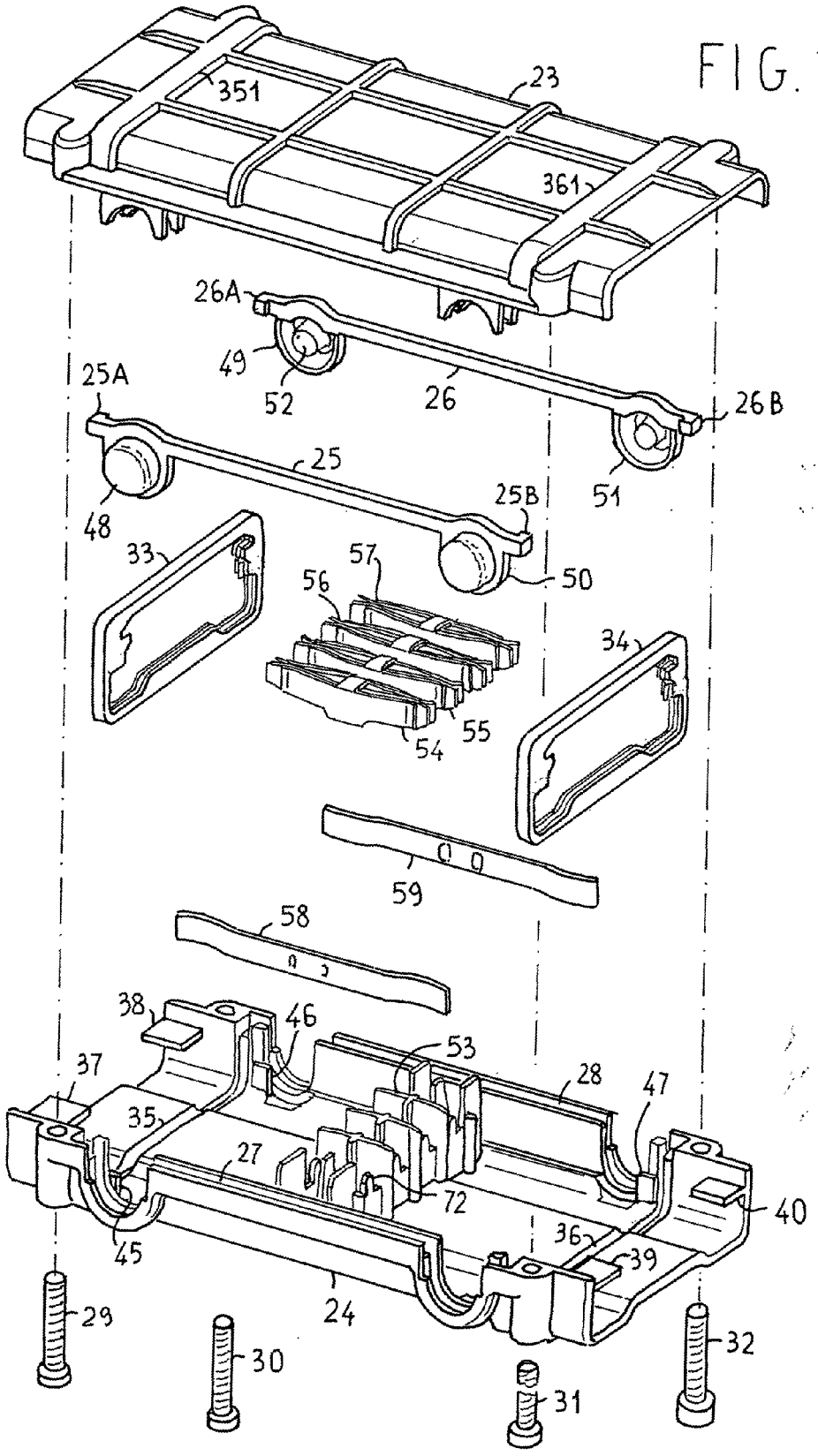
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FIG.4

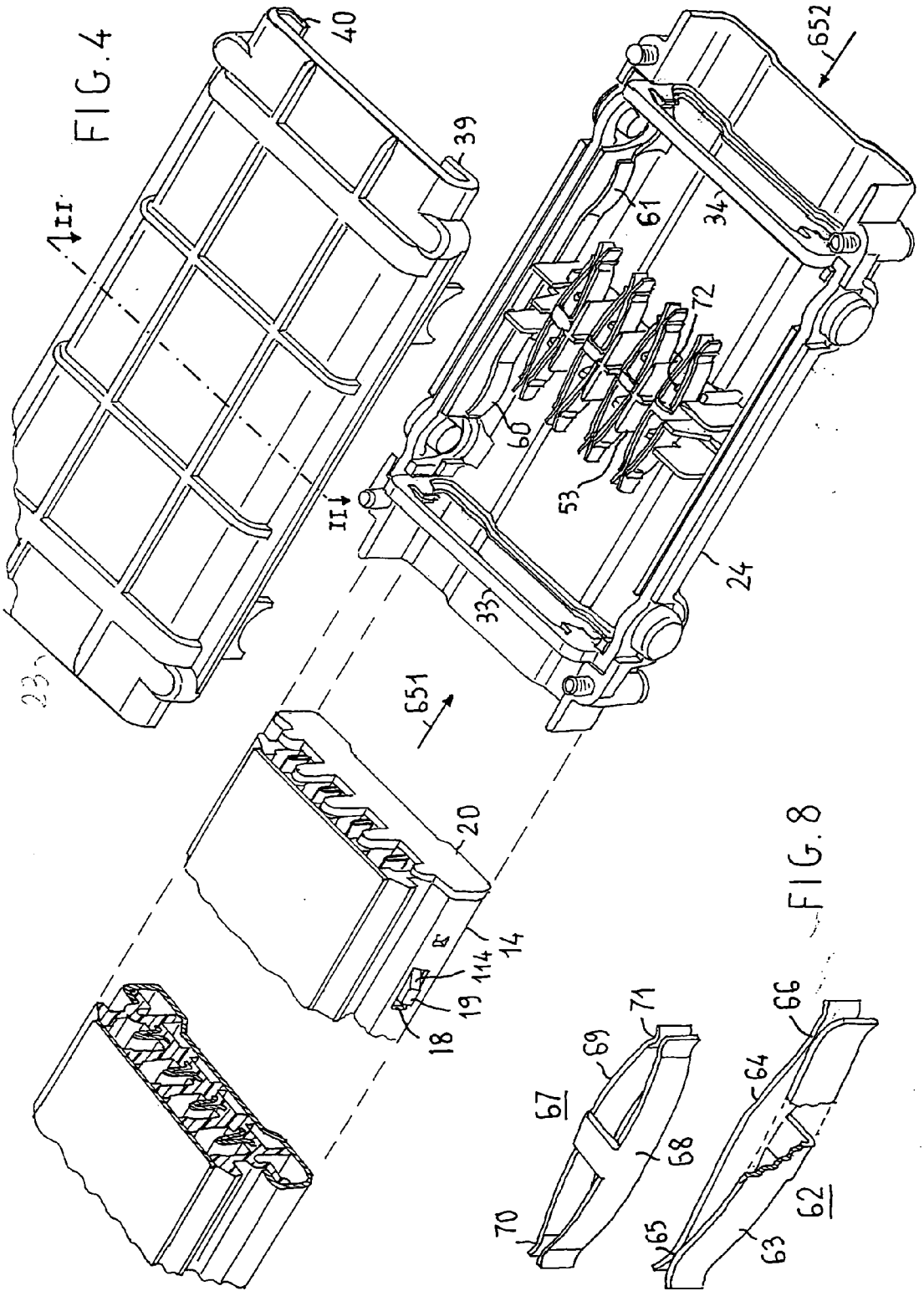
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FIG.8

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FIG. 9

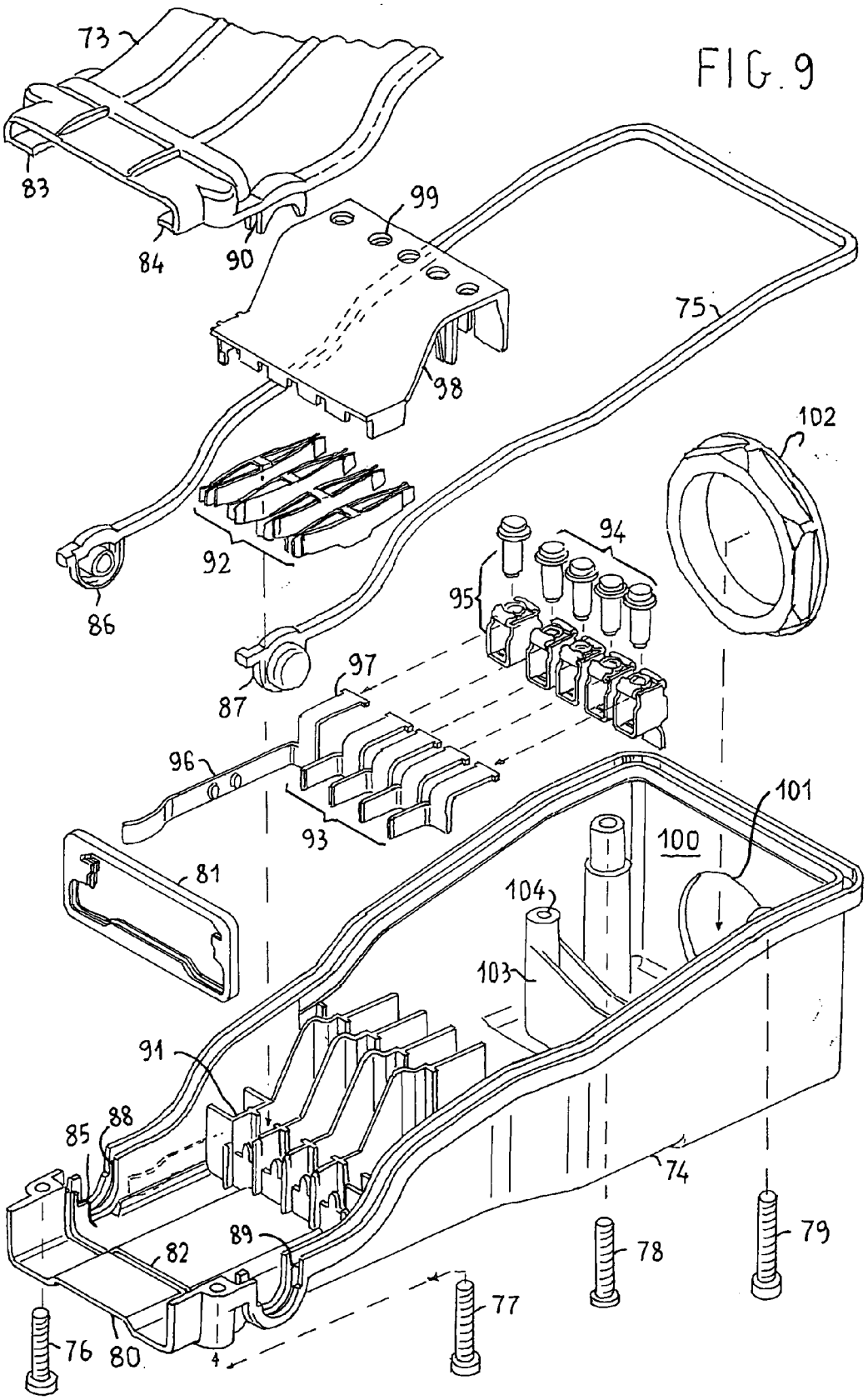
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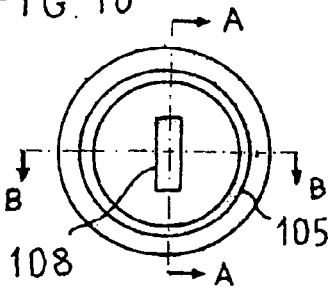
FIG. 10



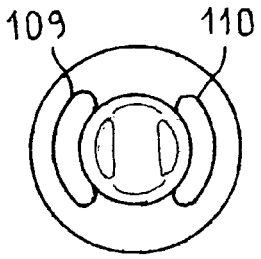


FIG. 11

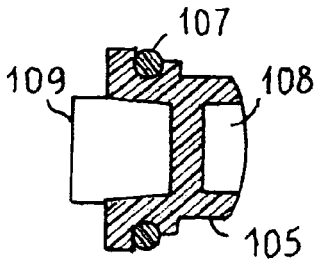


FIG. 12

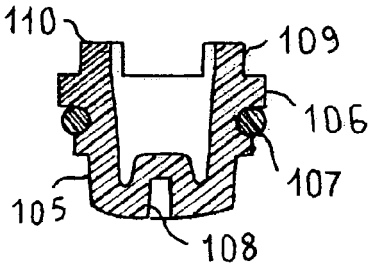


FIG. 13

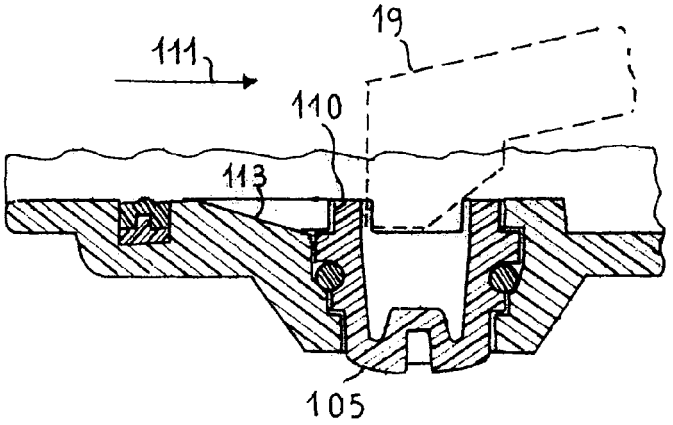


FIG. 14

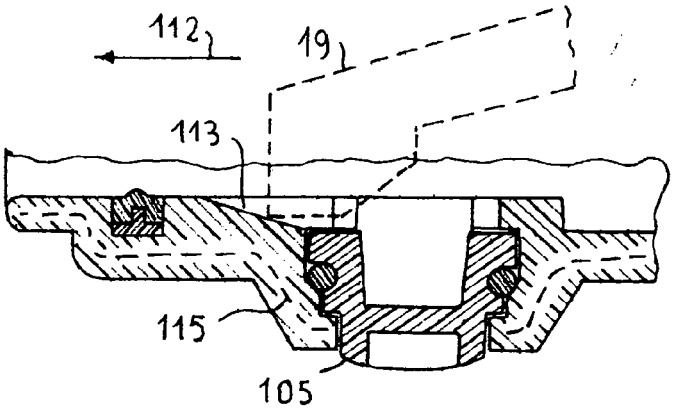


FIG. 15

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	21 April 2006	Kugler, D

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