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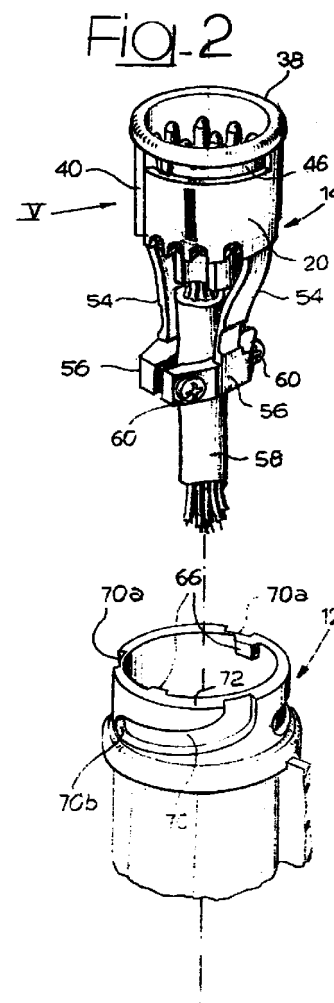
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(54) **Plug for electrical connection between a towing vehicle and a trailer**

(57) Plug for electrical connection between a towing vehicle and a trailer, comprising a casing (12), a contact-holder body (14) and a bayonet connection portion (68) for the connection of the plug (10) to a socket, in which the bayonet connection portion (68) can be rotated with respect to the contact-holder body (14) between a position of insertion of the plug into the socket and a position in which the plug is locked in the socket. The bayonet connection portion (68) is fixed with respect to the casing (12). The casing (12) and the contact-holder body (14) are fitted with mutually engaging means of retention (66, 46) which axially hold the contact-holder body (14) on the casing (12) and leave freedom of relative rotation between the contact-holder body (14) and the casing (12) between said insertion and locked positions.



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Description

[0001] This invention relates to a plug for electrical connection between a towing vehicle and a trailer, of the type comprising a casing, a contact-holder body and a bayonet connection portion for the connection of the plug to a socket, and in which the bayonet connection portion can be rotated with respect to the contact-holder body between a position of insertion of the plug into the socket and a position in which the plug is locked in the socket.

[0002] Plugs of this kind are made in compliance with ISO standard 11446-1993 and one form of a plug of the type specified above is described in the document EP-A-0249181.

[0003] In the plug described in that document, the casing comprises a front section and a rear section composed of two separate elements joined together by a threaded connection. The contact-holder body is fixed with respect to the casing and is gripped axially between the front section and the rear section. The bayonet connection section is formed on a ring which is mounted rotatably on the front section of the casing.

[0004] The object of this invention is to provide a plug which complies with the technical specifications of ISO standard 7638-1985 and which is simpler, less costly and made up of a smaller number of components compared with the plug described in the abovementioned document EP-A-0249181.

[0005] According to the present invention, this object is achieved by a plug with the characteristics forming the subject of the main claim.

[0006] The characteristics and advantages of this invention will be evident in the course of the detailed description which follows, given purely by way of non-restrictive example, with reference to the attached drawings, in which:

- figure 1 is a perspective view of a plug according to the present invention,
- figure 2 in an exploded perspective view of the plug in figure 1,
- figure 3 is a section on the plane marked III-III in figure 1,
- figure 4 is an exploded longitudinal section through the plug in figure 3,
- figure 5 is a view on a larger scale of the contact-holder body indicated by the arrow V in figure 2,
- figure 6 is a section on the plane marked VI-VI in figure 5,
- figure 7 is a plan view of the cover indicated by the arrow VII in figure 1,
- figure 8 is a section on the plane marked VIII-VIII in figure 7,
- figure 9 is a lateral view of an adapter device including a plug according to the invention, and
- figures 10 and 11 are views indicated by the arrows X and XI of figure 9.

[0007] With reference to figures 1 to 4, the reference number 10 indicates a plug for the electrical connection between a towing vehicle and a trailer. The plug 10 comprises a casing 12 and a contact-holder body 14, both made of injection-moulded plastic material.

[0008] As can be seen in particular in figure 4, the contact-holder body 14 is made up of a monolithic element including a base wall 16 from which an annular side wall 18 with a cylindrical outer surface 20 and a cylindrical inner surface 22 protrudes. A rib 24 parallel to the axis of the annular wall 18 protrudes radially inwards from the cylindrical inner surface 22. This rib is designed to engage with a longitudinal groove formed in a socket (not illustrated) so as to align the contact-holder body 14 and the socket with each other. There is a plurality of apertures 26 in the base wall 16 of the contact-holder body 14 for receiving respective metal contacts in pin form 28. Each aperture 26 is associated with its own spring retention portions 30 for engaging with re-entering portions 32 of the contacts 28 to axially lock the contacts when these have been inserted into the respective apertures 26 in the direction indicated by the arrows 34 in figure 4. Each contact 28 is provided, in a known manner, with a hole for the insertion of an electric conductor which is fixed to the contact by tightening a little transverse screw 36.

[0009] With reference to figures 5 and 6, the contact-holder body 14 has an annular edge 38 protruding radially out from the cylindrical outer surface 20 and arranged at the opposite end of the wall 20 from the base wall 16. At least one longitudinal groove 40 (figure 5) is formed on the cylindrical outer wall 20 of the contact-holder body 14 and runs parallel to the longitudinal axis 42 of the contact-holder body. Preferably, the contact-holder body is provided with two or more angularly equidistant grooves 40. Each groove 40 extends from the rear edge 44 of the cylindrical surface 20 to the protruding annular edge 38. Again referring to figures 5 and 6, the contact-holder body 14 has at least one circumferential groove 46 preferably arranged adjacent to the protruding annular edge 38. In the example illustrated in the figures, the contact-holder body 14 is provided with two circumferential grooves 46 each of which communicates with a respective longitudinal groove 40. Each circumferential groove 46 has a step 48 arranged in the vicinity of its respective longitudinal groove 40. The step 48 has a surface in the form of a moderately inclined ramp 48a turned towards the longitudinal groove 40 and a steep stop surface 48b turned towards the circumferential groove 46. Each circumferential groove 46 terminates against a stop surface 50. A pair of small opposed teeth 52 protrude from the side walls of each circumferential groove 46.

[0010] Each contact-holder body 14 also has one cable grip formed in an integral manner, including two elastically deformable opposed arms 54 protruding from the base wall 16 of the contact-holder body 14. At their respective ends, the arms 54 have enlarged head por-

tions 56 suitable for gripping a cable 58 between them. Figure 5 illustrates the arms 54 in their undeformed rest position, in which they are bent outwards in such a way as not to obstruct the insertion of the pins through the apertures formed in the base wall 16. After connecting the electric conductors and their respective contacts 28, the two head portions 56 are fixed to each other by screws 60 and clamp the cable 58 between them as shown in figure 2. With reference to figures 1 to 4, the casing 12 is formed by a monolithic body in a rigid plastic material and includes a platform 62 on which the cover of a socket (not illustrated) is intended to rest in the configuration in which the plug 10 is inserted in the socket. The casing 12 has a cylindrical cavity 64 which receives the cylindrical outer surface 20 of the contact-holder body 14 with a little play. At least one tooth 66 protruding radially inwards is formed on the cylindrical surface of the cavity 64. The number of the teeth 66 is equal to the number of the longitudinal grooves 40 formed on the contact-holder body 14. Therefore, in the embodiment illustrated as an example in the drawings, there are two teeth 66 staggered angularly 180° apart. The teeth 66 are intended to engage in the circumferential grooves 46 in a way which will be described below, so as to axially retain the contact-holder body 14, nevertheless leaving the possibility of relative rotation between the casing 12 and the contact-holder body 14.

[0011] The casing 12 has a bayonet connection portion 68 formed in an integral manner with the casing and including three helical grooves 70 staggered angularly from each other, each having an end 70a open on the front edge 62 of the casing 12 and a second closed end 70b.

[0012] The plug 10 also comprises a sealing element 74 in a soft plastic material with a plurality of circumferential lips 76 which establish a tight contact with the inner cylindrical wall 64 of the casing 12. The sealing element 74 has an outer annular groove 78 in which is inserted an annular relief 80 formed at one end of the casing 12, to axially hold the sealing element 74 firmly on the casing 12. The sealing element 74 also has a through aperture 82 provided with annular sealing lips 84 which establish a tight contact with the outer surface of the cable 58. Preferably, the through aperture 82 of the sealing element 74 has two or more different diameters decreasing progressively towards that end of the sealing element 74 which is furthest from the casing 12 in such a way that the sealing element 74 can be adapted to cables with different diameters simply by cutting the part or parts of the sealing element with a smaller through aperture diameter than the diameter of the cable.

[0013] The assembly of the plug according to this invention is as follows.

[0014] As has already been explained above, the contacts in pin form 28 are inserted into their respective apertures 26 in the contact-holder body 14 and are held in a snap-in manner by the elastically deformable forma-

tions 30 (figure 4). A length of the end of the electric cable 58 is passed through the cavity in the casing 12 and through the sealing element 74. The ends of the conductors of the cable 58 are then connected to their various contacts 28 and then the cable-grip portions 56 are fixed together by tightening the screws 60. The sealing element 74 is then inserted into the casing 12 in the direction indicated by the arrow 86 in figure 4 until the annular protrusion 80 is inserted into the casing 12 in the outer annular groove 78 of the sealing element 74.

[0015] The contact-holder body 14 is then inserted into the cavity 64 of the casing 12 in the direction indicated by the arrow 86 in figure 4. To be able to insert the contact-holder body 14 into the cavity 64 it is necessary for the longitudinal grooves 40 to be aligned with the protruding teeth 66. The teeth 66 then engage in the longitudinal grooves 40 during the axial movement of the contact-holder body 14 with respect to the casing 12. When the outer annular protrusion 38 of the contact-holder body 14 is stopped by the front edge 72 of the casing 12, the teeth 66 are aligned with the circumferential grooves 46. In this condition, a relative rotation is applied between the contact-holder body 14 and the casing 12 in such a way that the teeth 66 pass over the steps 48 and enter the respective circumferential grooves 46. To make the teeth 66 pass over the steps 48, it is necessary to apply a certain degree of torque. To do this, the contact-holder body 14 can be gripped using a tool formed in such a way as to engage with the inner radial rib 24. When the teeth 66 of the casing 12 have entered the circumferential grooves 46 the assembly of the plug is complete. The contact-holder body 14 is axially held on the casing 12 thanks to the engagement of the teeth 66 in the circumferential grooves 46. However, the casing 12 can rotate with respect to the contact-holder body 14 between a position of insertion of the plug into the socket and a position in which the plug is locked with respect to the socket. The little teeth 52 formed on the side walls of the circumferential grooves 46 define the position of insertion of the plug 12. When the teeth 66 are retained between the stop surface 48b and the little teeth 52, the plug 10 is ready to be inserted in a socket.

[0016] The teeth 66 can pass over the little teeth 52 with the application of a much smaller force than that required to pass over the step 48. During insertion, the inner radial rib 24 of the contact-holder body 14 engages in a corresponding groove in the socket which defines the position of alignment of the contacts 28 with the corresponding socket contacts. During the insertion of the plug into the socket, the helical grooves 70 of the bayonet connection portion 68 are engaged by respective radial pins borne by the socket. During insertion, the casing 12 rotates with respect to the contact-holder body 14 and with respect to the socket, from the insertion position to a locked position. The angular amplitude of the rotation of the casing 12 is identical to the angular amplitude of the helical grooves 70. When the pins

reach the ends 70b of the helical grooves 70 the casing 12 has reached the locked position in which the platform 72 is aligned with the cover of the plug. In the locked position, the front edge 38 of the contact-holder body 14 is pressed axially against a gasket (not illustrated) on the socket.

[0017] With reference to figures 1, 7 and 8, 88 indicates an auxiliary closing cover which can be used for closing the plug 10 when the latter is not coupled with the socket. The cover 88 has a cylindrical inner surface 90 from which a plurality of pins 92 protrude to engage in the helical grooves 70 formed on the casing 12, in the same way as these grooves are engaged by the pins formed on the socket. In accordance with an advantageous characteristic of this invention, the closing cover 88 has a longitudinal groove 94 formed on a protruding annular wall 96. The groove 94 is made in such a way as to couple with the radial rib 24 (figure 4) of the contact-holder body 14. In this way, the closing cover 88 can be advantageously used as a tool for assembling and disassembling the contact-holder body 14 from the casing 12 because, owing to the engagement of the groove 94 with the rib 24, the cover 88 can be used to keep the contact-holder body 14 still when applying the necessary torque on the casing 12 so that the teeth 66 pass over the corresponding steps 48. The closing cover 88 is preferably fitted with protruding flanges 98 provided with holes 100 which can be used for fixing the cover 88 to the trailer, in such a way that the cover 88 is not lost when the plug 10 is engaged with the socket. When the trailer is detached from the towing vehicle, the socket 10 can be fitted onto the cover 88 to prevent the entry of water or dirt in the area of the contacts 28.

[0018] With reference to figures 9 to 11, the plug according to this invention can also be utilized for making an adapter device which allows a plug and a socket with different numbers of poles to be connected up. For example, it is frequently necessary to establish an electrical connection between a 7-pole plug fitted on a trailer with a 13-pole socket fitted on a towing vehicle. In this case, an adapter device of the type shown in figure 9 is used, having on one side a plug 10 with the right number of poles for coupling with the socket mounted on the towing vehicle (13 for example) and on the other side a socket 110 with the right number of holes for coupling with the plug mounted on the trailer (7 for example). The plug 10 is made in much the same way as described above. The only difference consists in the fact that there is no sealing element 74 in soft material and the casing 12 has a portion 112 to which a standard socket 110 is fitted. An electric cable is housed inside the casing 12 to connect the contacts 114 of the socket 110 with the corresponding contacts 28 of the plug 10.

[0019] The plug according to the present invention can be the subject of numerous constructional variants compared with what has been described above. In particular, the connection between the contact-holder body 14 and the casing 12 can be made in any way suitable

for axially retaining the contact-holder body 14 with respect to the casing 12, while still permitting freedom of relative rotation between them. For example, the circumferential grooves 46 could be formed on the inner surface of the casing 12 and the teeth 66 on the outer surface of the contact-holder body 14. Furthermore, the bayonet connection portion 68 of the casing 12 could be formed on a component separate from the casing and fixed to the remaining part of the casing in a permanent manner or in a removable manner.

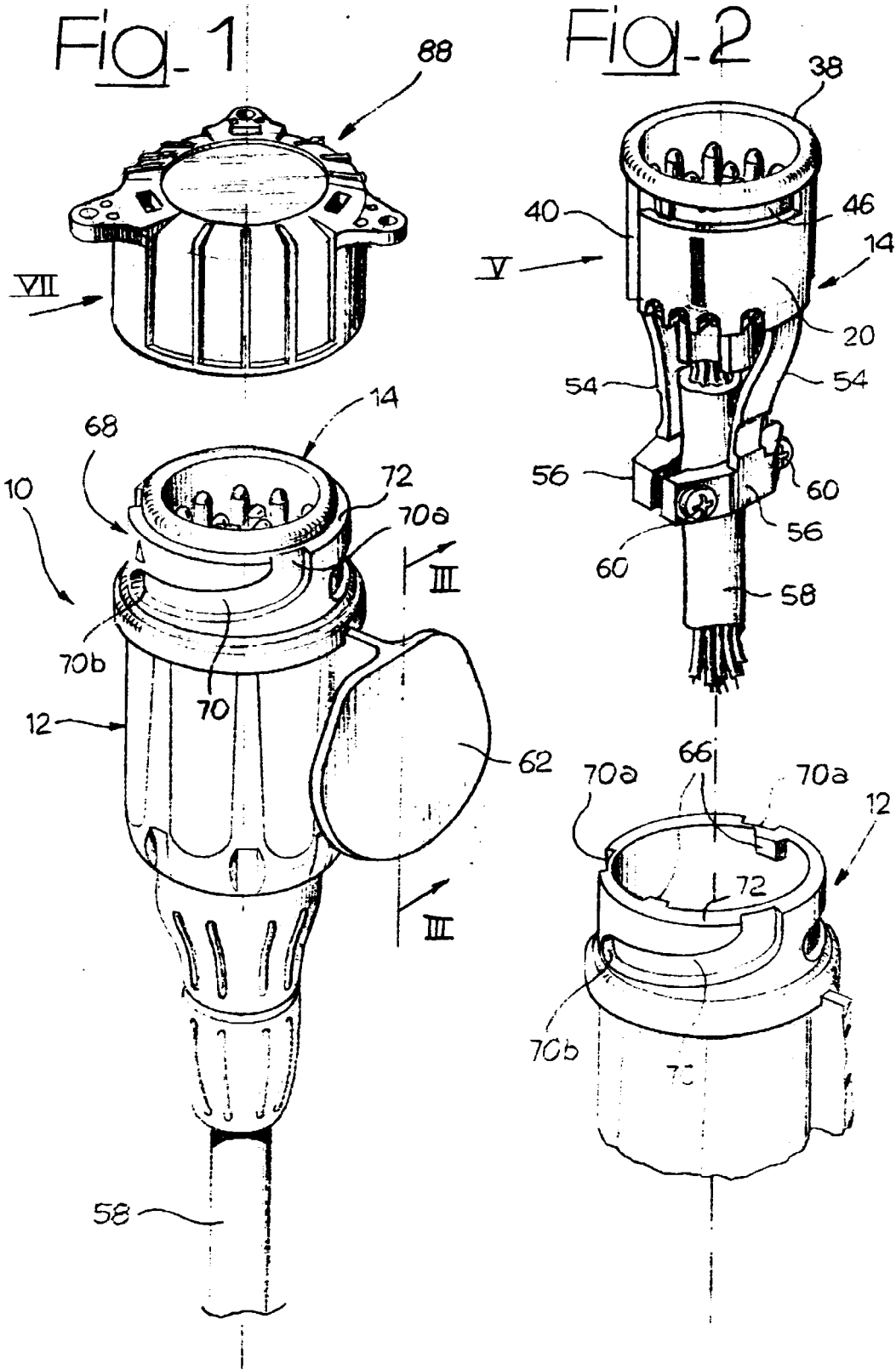
Claims

1. Plug for electrical connection between a towing vehicle and a trailer, comprising a casing (12), a contact-holder body (14) and a bayonet connection portion (68) for the connection of the plug (10) to a socket, in which the bayonet connection portion (68) can be rotated with respect to the contact-holder body (14) between a position of insertion of the plug into the socket and a position in which the plug is locked in the socket, characterized in that the bayonet connection portion (68) is fixed with respect to the casing (12) and in that the casing (12) and the contact-holder body (14) are fitted with mutually engaging means of retention (66, 46) which axially hold the contact-holder body (14) on the casing (12) and leave freedom of relative rotation between the contact-holder body (14) and the casing (12) between said insertion and locked positions.
2. Plug according to Claim 1, characterized in that said means of retention comprise at least one radial tooth (44) borne by the casing (12) or by the contact-holder body (14) and engaging with at least one circumferential groove (46) formed on the contact-holder body (14) or on the casing (12).
3. Plug according to Claim 2, characterized in that the abovementioned circumferential groove (46) communicates with an axial groove (40) which permits the insertion of the radial tooth (66) into the circumferential groove (46) following a relative movement in the axial direction of the contact-holder body (14) and of the casing (12).
4. Plug according to Claim 3, characterized in that the abovementioned circumferential groove (46) has a step (48) over which the abovementioned radial tooth (66) passes as a result of the application of a predetermined torque between the contact-holder body (14) and the casing (12).
5. Plug according to Claim 4, characterized in that it also comprises a pair of small teeth (52) formed in said circumferential groove (46) to retain the abovementioned radial tooth (66) in the abovementioned

position of insertion of the plug (10) into the socket.

6. Plug according to any of Claims 2 to 5, characterized in that the abovementioned circumferential groove (46) is formed on an outer surface (20) of the contact-holder body (14) and in that the abovementioned radial tooth (66) is formed on an inner surface (64) of the casing (12). 5
7. Plug according to Claim 1, characterized in that the abovementioned bayonet connection portion (68) is formed in an integral manner with the casing (12). 10
8. Plug according to Claim 1, characterized in that the abovementioned contact-holder body (14) is formed by a monolithic element with a base wall (16) provided with a plurality of holes (26) suitable for receiving and retaining respective contacts (28) in a snap-in manner. 15
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9. Plug according to Claim 8, characterized in that the abovementioned contact-holder body (14) comprises a pair of integral deformable arms (54) suitable for gripping a cable (58). 25
10. Plug according to Claim 1, characterized in that it comprises a sealing element in deformable material (74) fixed to the casing (12) by the engagement of an annular protrusion (80) from the casing (12) in an annular groove (78) on the sealing element (74). 30
11. Plug according to Claim 10, characterized in that the abovementioned sealing element (74) has at least one annular sealing lip (76) suitable for establishing a tight contact with an inner surface (64) of the casing (12). 35
12. Plug according to Claim 1, characterized in that it comprises an auxiliary closing cover (88) provided with means (94) for engaging the contact-holder body (14). 40
13. Plug according to Claim 1, characterized in that the abovementioned auxiliary closing cover (88) has an axial groove (94) for engaging an axial rib (24) protruding from an inner surface (22) of the contact-holder body (14). 45
14. Adapter device for electrical connection between a plug and a socket with different numbers of poles, characterized in that it comprises a plug (10) according to one or more of the previous claims. 50

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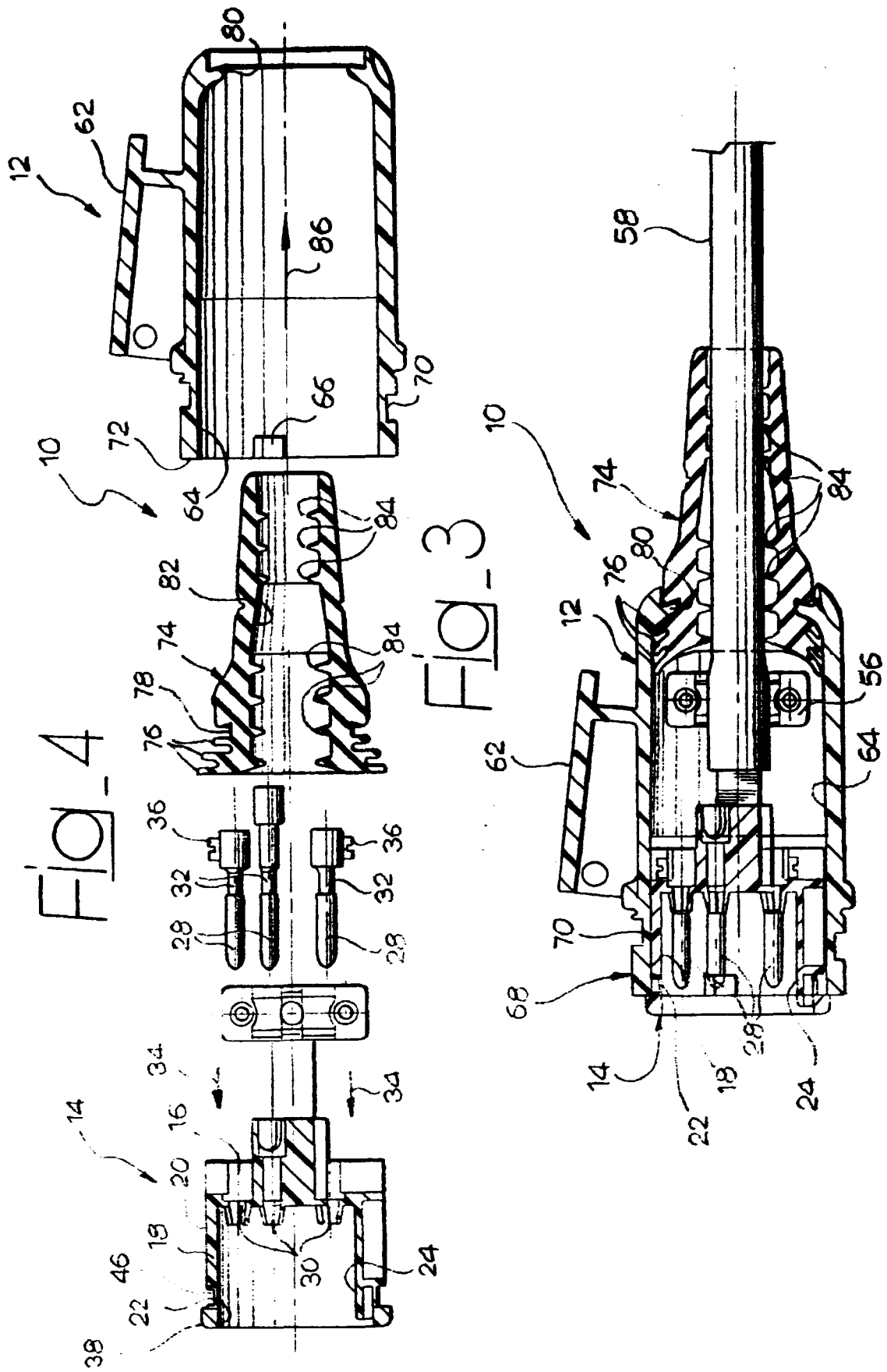


Fig. 5

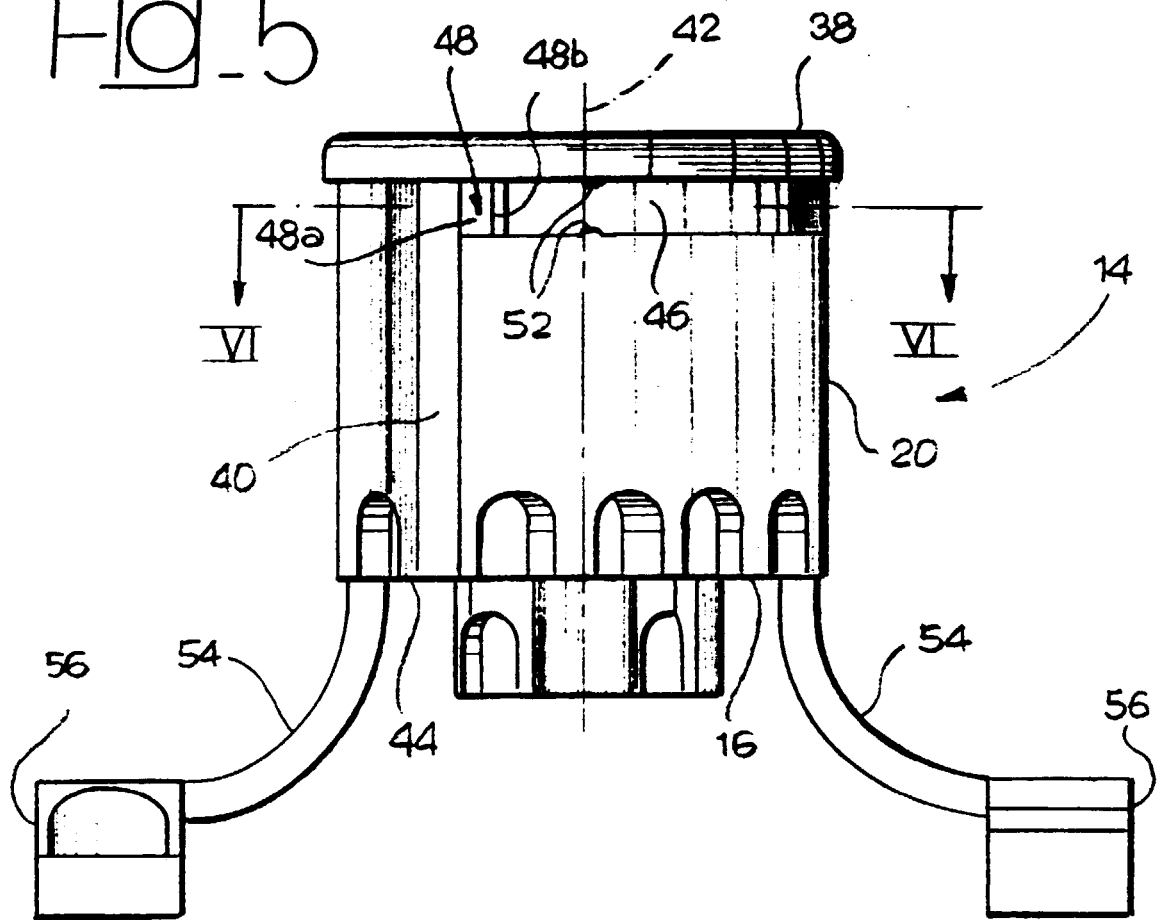


Fig. 6

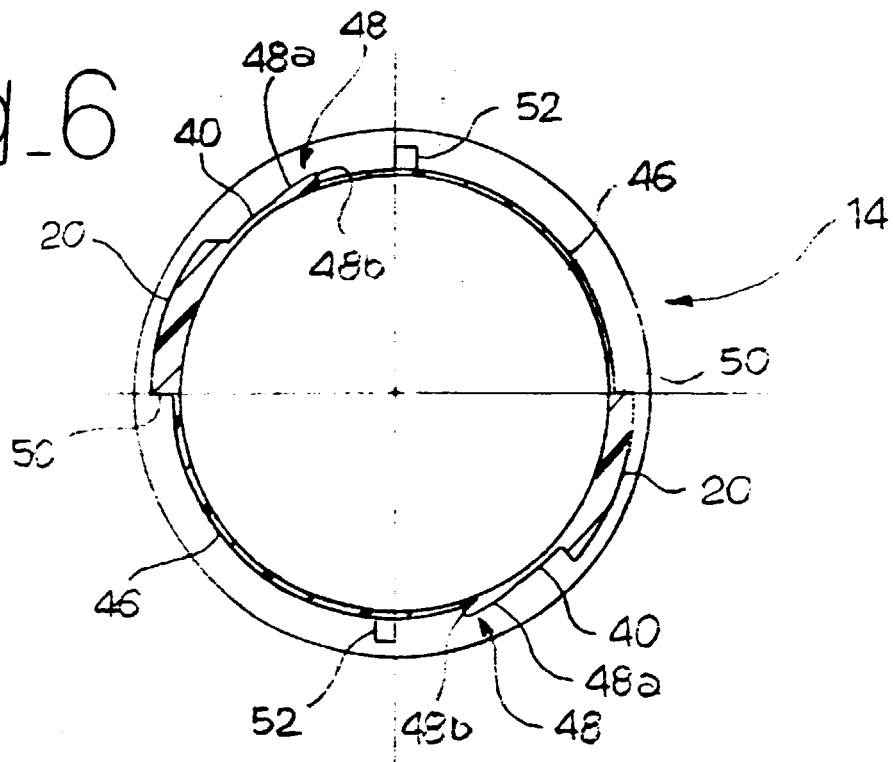


Fig. 7

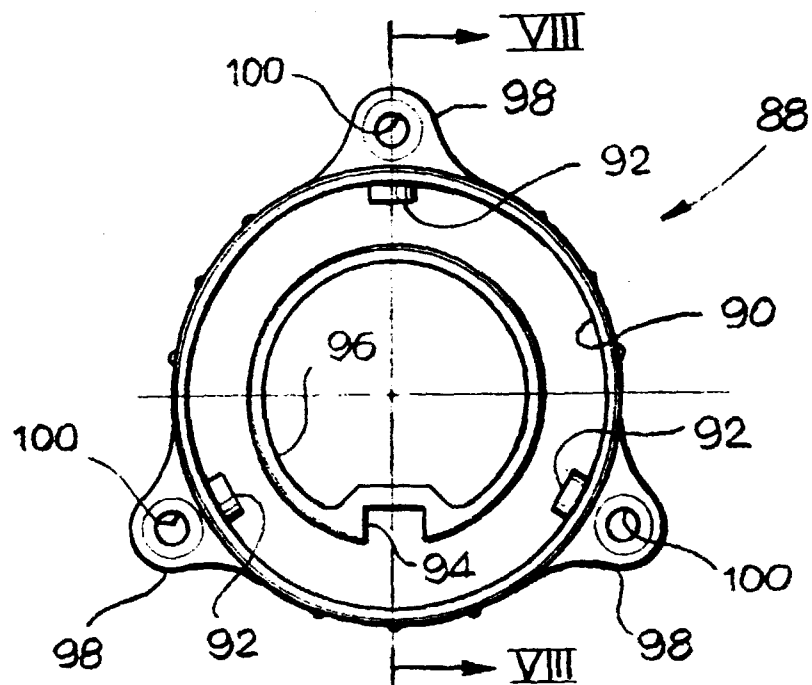
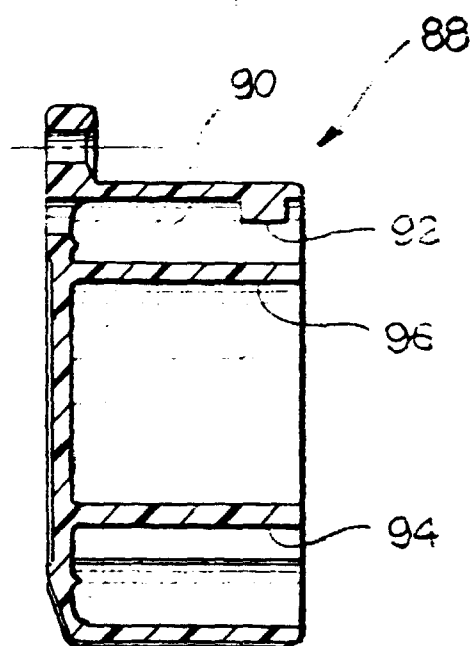
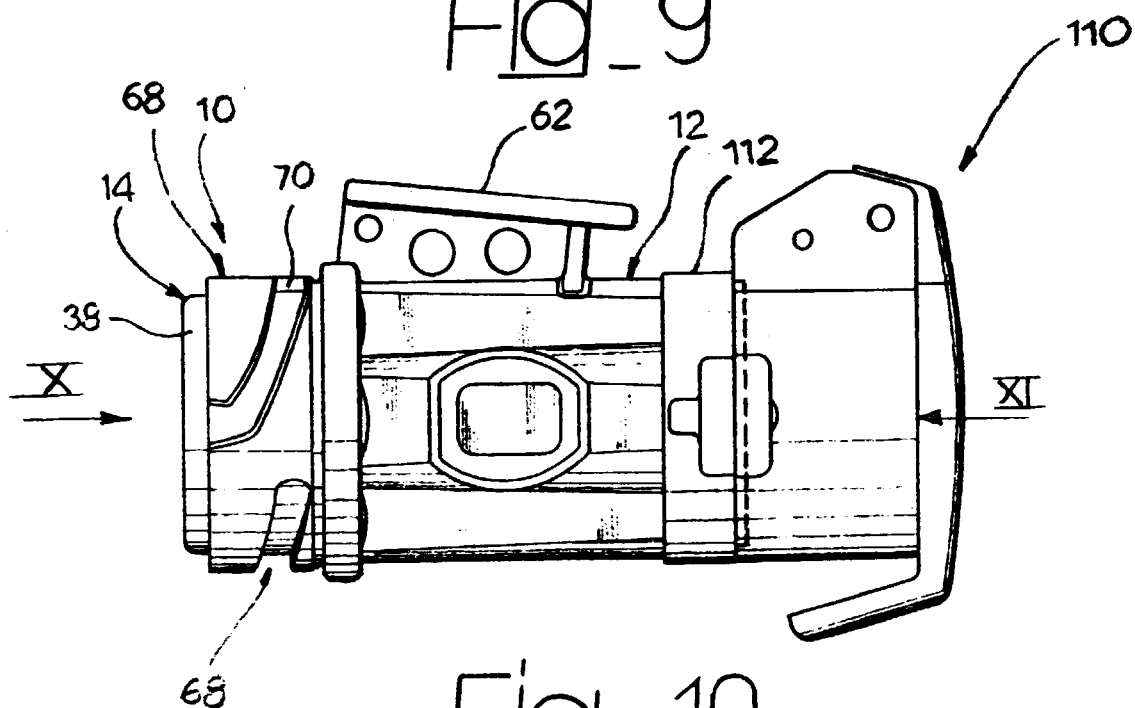


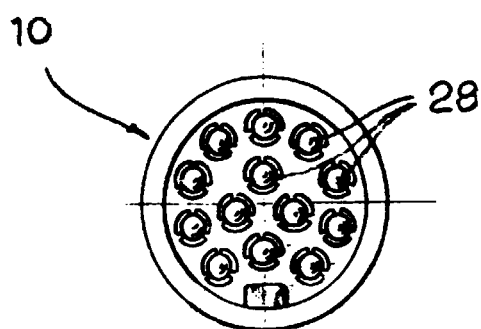
Fig. 8



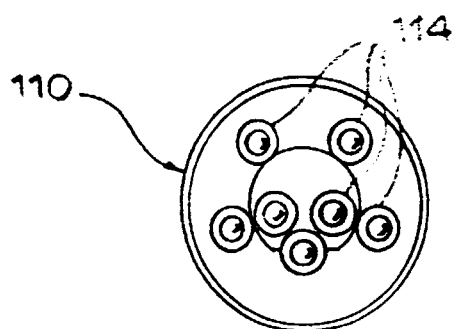
Fig_9



Fig_10



Fig_11





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EUROPEAN SEARCH REPORT

Application Number
EP 00 10 6412

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	EP 0 620 615 A (SUMITOMO WIRING SYSTEMS) 19 October 1994 (1994-10-19) * column 4, line 1 - line 25 * * column 5, line 27 - line 34 * * figure 4 *	1,7	H01R13/625
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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			H01R
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 18 July 2000	Examiner Stirn, J-P
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 00 10 6412

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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