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(12) # EUROPEAN PATENT APPLICATION

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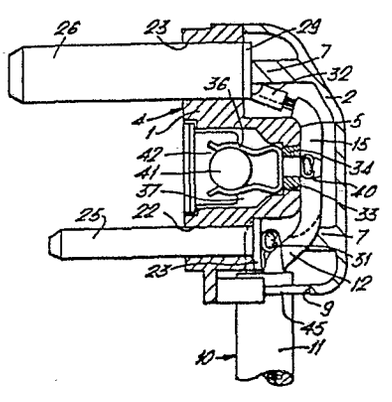
(54) **An improved electric plug assembly.**

(57) In an electric plug assembly, e.g. a three pin domestic electric plug, in which a moulded plug body (not shown) is encapsulating the conductor terminals of the pins and is permanently bonded to a length of cable (10), a preformed insulating cover (2) of a material harder than that of the moulded plug body is encapsulated in the moulded plug body and bears against and overlies at least the line and neutral pins (25) and associated conductor terminals to hold the pins firmly in position and to form a guard between the terminals and the outer part of the plug body.

Fig. 3.



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AN IMPROVED ELECTRIC PLUG ASSEMBLY

This invention relates to the manufacture of an electric plug assembly of the kind in which the plug pins and associated conductor terminals are mounted in a preformed body of electrically insulating material, the conductors of a length of flexible insulated multi-conductor cable are electrically connected to appropriate terminals of the plug, and a moulded plug body of electrically insulating material wholly or partially encapsulates the preformed body and the plug pins and associated conductor terminals with an appropriate length of each pin protruding from a face of the plug assembly (hereinafter referred to as the rear face) and is permanently bonded to the insulating covering of a part of the length of the cable. Electric plug assemblies of this kind will hereinafter, for convenience, be referred to as "of the kind described".

The invention is especially, but not exclusively, concerned with three pin electric plug assemblies of the kind described suitable for use with domestic electrical appliances and with other three pin electric plug assemblies of the kind described which incorporate means for electrically connecting a cartridge fuse between the line pin and its associated conductor terminal.

According to the present invention we provide an improved electric plug assembly of the kind described, wherein a preformed cover of an electrically insulating material that

is substantially harder than the moulded insulating material of the plug body is encapsulated in the moulded plug body and is of such a shape and form and is so connected to the preformed body that it bears against and overlies the inner ends of at least the line and neutral pins and associated conductor terminals thereby to hold said pins firmly in position in the preformed body and to form a guard between said terminals and the outer part of the plug body.

Preferably, the preformed cover bears against and overlies the inner ends of all the pins and associated conductor terminals thereby to hold all pins firmly in position in the preformed body and to form a guard between all terminals and the outer part of the plug body.

The provision of the preformed cover serves the dual purpose of holding the plug pins against which it bears firmly in position during moulding of the plug body and of eliminating or substantially reducing the risk that a conductor wire or conductor wires may protrude through the moulded plug body and constitute a dangerous hazard to a user of the plug.

Preferably, the preformed cover is initially detachably connected to the preformed body in which the plug pins and associated conductor terminals are mounted and in a preferred embodiment the preformed cover has protuberances which are snap fits in appropriately located holes or recesses in the preformed body.

In a preferred embodiment the preformed cover comprises a top and a side wall or side walls, an aperture being provided in a side wall, or one of the side walls being omitted, to provide access for the flexible cable.

The preformed cover may have protruding inwardly of its top, ribs which are so positioned that, when the cover is

connected to the preformed body, they bear against the inner ends of the plug pins and hold them firmly in position during moulding of the plug body. Where the preformed body has separately formed cable-gripping means detachably mounted on the body, a rib or side wall of the preformed cover may hold the cable-gripping means firmly in position. Alternatively, a side wall of the preformed cover and a neighbouring part of the preformed body may be appropriately shaped so as to co-operate to form means for gripping the cable, or a side wall of the preformed cover may be appropriately shaped so as to form means for gripping the cable.

Where, for example, the moulded plug body is of urea or polyester, preferably the preformed cover is of nylon or polyester.

The invention also includes an improved method of manufacturing an improved electric plug assembly as herein-before described, which comprises the steps of effecting the electrical and/or mechanical connections between the plug pins and their associated conductor terminals and the electrical connections between the cable conductors and the conductor terminals; introducing the plug pins and their associated conductor terminals, with the cable conductors electrically connected thereto, into holes and recesses in the front face of the preformed body so that appropriate lengths of the pins protrude from the rear face thereof; connecting to the pre-formed body a preformed cover which is of a substantially hard electrically insulating material and which is of such a shape and form that it bears against and overlies the inner ends of at least the line and neutral pins and associated conductor terminals to hold said pins firmly in position in the preformed body; and moulding therearound an electrically insulating material to form a moulded plug body which wholly

or partially encapsulates the preformed body, the preformed cover and the plug pins and associated conductor terminals and which is bonded to the insulating covering of a part of the lengths of the flexible cable.

Where the plug assembly is to include means for electrically connecting a cartridge fuse between the line pin and its associated conductor terminal, preferably said means comprises two spaced electrical contacts, one of which is electrically and/or mechanically connected to the line pin and the other to its associated conductor terminal before they are introduced into the preformed body and which are introduced into slots in the front face of the body so that they protrude into a cartridge-fuse recess in the rear face of the body.

Alternatively, the two spaced electrical contacts are carried on a single preformed carrier or on two separate preformed carriers of insulating material, which contacts are electrically and/or mechanically connected to the line pin and its associated conductor terminal before they are introduced into the preformed body and which are introduced into a hole or holes in the front face of the body so that they protrude into a cartridge-fuse recess in the rear face of the body with their carrier or carriers fitting tightly in the hole or holes to prevent insulating material of the plug body from entering the fuse recess when it is moulded around the preformed body, the preformed cover and the pins and conductor terminals. Preferably, the two electrical contacts are carried on a carrier of rectangular shape which is a tight fit in a hole of corresponding shape. To ensure that the carrier is a tight fit in the hole, preferably the walls of the hole converge towards one another in a direction towards the rear face of the preformed body and the side faces of the carrier are of comple-

mentary shape, the tightness of the fit thereby increasing as the carrier is introduced into the hole from the front face of the body. One or each of the electrical contacts preferably is a spring clip for gripping a terminal of a cartridge fuse and also is preferably of such a shape and size, having regard to the size of its associated hole, that when the carrier on which the spring clip or clips is or are carried is fully home in the hole, the spring clip or clips effect a snap fit so that the carrier cannot subsequently be withdrawn.

The conductors of the flexible cable may be electrically connected to the conductor terminals in any convenient manner, a crimped connection being preferred.

The invention also includes an electric plug assembly of the kind described manufactured by the method as hereinbefore described.

Two preferred forms of 13A three pin electric plug assembly of the kind described in accordance with the invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is an exploded view of a preformed body (with the plug pins and conductor terminals omitted) and a preformed cover of one plug assembly:

Figure 2 is a front view of the plug assembly in Figure 1 with the moulded plug body and preformed cover omitted;

Figure 3 is a sectional side view taken on the line III - III in Figure 2 with the preformed cover in position:

Figure 4 is a view, partly in section and partly in elevation, of the fuse clips carrier with two fuse clips mounted thereon:

Figure 5 is an exploded view of a preformed body (with the plug pins and conductor terminals omitted) and the preformed cover of an alternative three-pin electric plug assembly in accordance with the invention;

Figure 6 is a front view of the plug assembly in Figure 5 with the moulded body and preformed cover omitted; and

Figure 7 is a sectional side view taken on the line VII - VII in Figure 6 with the preformed cover in position and with the conductors and conductor terminals omitted.

Referring to Figures 1 to 4, the electric plug assembly comprises a preformed body 1 of moulded plastics insulating material such as urea, a preformed cover 2 of moulded plastics insulating material such as nylon which is detachably connected to the body 1 and, encapsulating the cover 2 and the body 1 in such a way that the rear face 4 of the body is exposed, a plug body (not shown) of moulded thermoplastics material which is bonded to the insulating covering 11 of a flexible cable 10.

The preformed body 1 has apertures 21, 22 and 23 through which protrude a line pin 24, a neutral pin 25 and earth pin 26. Mechanically and electrically secured to the neutral pin 25 is a conductor terminal 28 to which the neutral conductor 14 of the flexible cable 10 is electrically connected by a crimped connection 31. A conductor terminal 29 is mechanically and electrically connected to the earth pin 26 and the earth conductor 15 of the flexible cable 10 is electrically connected to the terminal 29 by a crimped connection 32.

In snap engagement in a rectangular hole 33 in the preformed body 1 is a carrier 34 of moulded plastics material which carries at its opposite ends spring clips 35 and 36

located in a cartridge-fuse recess 37 in the rear face 4 of the body. As will be seen on referring to Figure 3, the walls of the hole 33 converge towards one another in a direction towards the rear face 4 of the body 1 and the side faces of the carrier 34 are of complementary shape, the tightness of the fit of the carrier in the hole thereby increasing as the carrier is introduced into the hole from the front face 5 of the body. The spring clips 35 and 36 are each of such a shape and size, having regard to the size of the hole 33, that when the carrier 34 is fully home in the hole, the spring clips effect a snap fit so that the carrier cannot subsequently be withdrawn.

Mechanically and electrically connected to the line pin 24 is a conductor terminal 27 which is electrically connected to the spring clip 35 through a length 30 of conductor, one end of which is electrically connected to the conductor terminal 27 by a crimped connection 38 and the other end of which is electrically connected to the spring clip 35 by a crimped connection 39. The line conductor 12 of the flexible cable 10 is electrically connected to the spring clip 36 by a crimped connection 40. The spring clips 35 and 36 are electrically connected through a cartridge fuse 41.

The cartridge-fuse recess 37 in the rear face 4 of the body 1 is closed by a removable cover 42.

The preformed cover 2, which overlies and provides a guard for the electrical connections on the front face 5 of the preformed body 1, is detachably connected to the body 1 through stepped flexible protuberances 6, which are in snap engagement in holes 43 in the preformed body. The cover 2 has inwardly directed ribs 7 which bear against the ends of the conductor terminals connected to the pins and, when the cover

is connected to the body 1, serve to retain the pins in their apertures. At one end of the cover 2 is an opening 9 for passage of the flexible cable 10, the cable being gripped to prevent strain from being imparted to the cable conductor connections by a separately formed cable-gripping member 45 which engages in a slot in the body 1 and is held therein by the cover 2. The cover 2 provides a guard against an unconnected wire or unconnected wires of a cable conductor from being caused to protrude through the plug body (not shown) during the moulding operation.

In manufacturing the electric plug assembly shown in the drawings, the conductor terminals are connected to the pins and the cable conductor connections are made before any of these parts are mounted on or in the preformed body 1, When these connections have been made, the pins 24, 25 and 26 are introduced into the apertures 21, 22 and 23, and the carrier 34 with the spring clips 35, 36 mounted thereon is introduced into the hole 33 from the front face of the preformed 1 until the pins are fully insulated and the carrier has snapped into place in the hole. The cover 2 is next detachably connected to the preformed body 1, thereby retaining the pins, and the cable-gripping member 45 which has previously been applied to the flexible cable 10 and engage in the slot in the body 1, in position. The assembly so formed is then placed in an appropriately shaped mould and molten thermoplastics material is injected into the mould to form a plug body which is bonded to the insulating covering 11 of the cable 10 and which fully encapsulates all the electrical connections of the plug assembly, leaving the rear face 4 of the body 1 exposed for insertion of an appropriate fuse 41 and closure by the removable cover 42 after the plug body has cooled.

In the alternative electric plug assembly shown in Figures 5 to 7, the preformed cover 102 has a raised portion 103 to allow a clearance around the cable 104. The preformed body 101 has two pairs of slots 105 and 106, each of which receives an approximately U-shaped metal spring clip 107 and 108. An arm of each spring clip 107 and 108 passes through a slot of each pair of slots 105 and 106 so that the free ends of the arms protrude into a cartridge-fuse recess 109 in the rear face 110 of the preformed body 101. A cartridge fuse 111 electrically connects the spring clips 107 and 108. The line pin 112 is mechanically and electrically connected to one of the spring clips 107 by a strip of shaped metal sheet 113. In all other respects the electric plug assembly shown in Figures 5 to 7 is substantially the same as that in Figures 1 to 4.

What we claim is -

1. An electric plug assembly of the kind which comprises a preformed body of electrically insulating material, at least two plug pins and associated conductor terminals mounted in the preformed body, the conductors of a length of flexible insulated multi-conductor cable being electrically connected to appropriate terminals of the plug, and a moulded plug body of electrically insulating material which wholly or partially encapsulates the preformed body and the plug pins and associated conductor terminals with an appropriate length of each pin protruding from the rear face of the plug assembly and which is permanently bonded to the insulating covering of a part of the length of the cable, characterised in that a preformed cover (2) of an electrically insulating material that is substantially harder than the moulded insulating material of the plug body is encapsulated in the moulded plug body and is of such a shape and form and is so connected to the preformed body (1) that it bears against and overlies the inner ends of at least the line and neutral pins (24,25) and associated conductor terminals (17,18) thereby to hold said pins firmly in position in

the preformed body and to form a guard between said terminals and the outer part of the plug body..

2. An electric plug assembly as claimed in Claim 1, characterised in that the preformed cover bears against and overlies the inner ends of all the pins and associated conductor terminals.

3. An electric plug assembly as claimed in Claim 1 or Claim 2, characterised in that the preformed cover is initially detachably connected to the preformed body in which the plug pins and associated conductor terminals are mounted.

4. An electric plug assembly as claimed in Claim 3. characterised in that the preformed cover has protuberances (6) which are snap fits in appropriately located holes (43) or recesses in the preformed body.

5. An electric plug assembly as claimed in any one of the preceding Claims, characterised in that the preformed cover comprises a top and a side wall or side walls, an aperture (9) being provided in a side wall, or one of the side walls being omitted, to provide access for the flexible cable.

6. An electric plug assembly as claimed in any one of the preceding Claims. characterised in that the preformed cover has protruding inwardly of its top, ribs (7) which are so positioned that, when the cover is connected to the preformed body. they bear against the inner ends of the plug

pins and associated conductor terminals and hold them firmly in position in the preformed body.

7. An electric plug assembly as claimed in any one of the preceding Claims, in which means are provided for electrically connecting a cartridge fuse between the line pin and the associated conductor terminal, characterised in that said cartridge fuse connecting means comprises two spaced electrical contacts (35.36) mounted on a carrier or carriers (34) which fits or fit tightly in a hole or holes (33) in the preformed body, the contacts protruding into a fuse recess (37) in the rear face of the preformed body.

8. An electric plug assembly as claimed in Claim 7, in which the two electrical contacts of the cartridge fuse connecting means are mounted on a single preformed carrier, characterised in that the carrier is of rectangular shape and the hole in the preformed body in which the carrier is a tight fit is of corresponding shape and has walls which converge towards one another in a direction towards the rear face of the preformed body, the side faces of the carrier being of complementary shape.

9. A method of manufacturing an electric plug assembly in accordance with any one of the preceding Claims, characterised in that the method comprises the steps of effecting the electrical and/or mechanical connections between the plug pins and their associated conductor terminals and the electrical connections between the cable conductors and the conductor terminals:

introducing the plug pins and their associated conductor terminals, with the cable conductors electrically connected thereto, into holes and recesses in the front face of the preformed body so that appropriate lengths of the pins protrude from the rear face thereof: connecting to the preformed body a preformed cover which is of a substantially hard electrically insulating material and which is of such a shape and form that it bears against and overlies the inner ends of at least the line and neutral pins and associated conductor terminals to hold said pins firmly in position in the preformed body: and moulding therearound an electrically insulating material to form a moulded plug body which wholly or partially encapsulates the preformed body, the preformed cover and the plug pins and associated conductor terminals and which is bonded to the insulating covering of a part of the length of the flexible cable.

10. A method of manufacturing an electrical plug assembly as claimed in Claim 9 characterised in that, before the preformed cover is connected to the preformed body, electrical and/or mechanical connections are effected between two spaced electrical contacts mounted on a preformed carrier of a cartridge fuse connecting means and the line pin and its associated terminal, and the carrier is fitted tightly into a hole in the preformed body from the front face of the body so that the two spaced electrical contacts protrude into a fuse recess in the rear face of the preformed body.

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Fig. 1.

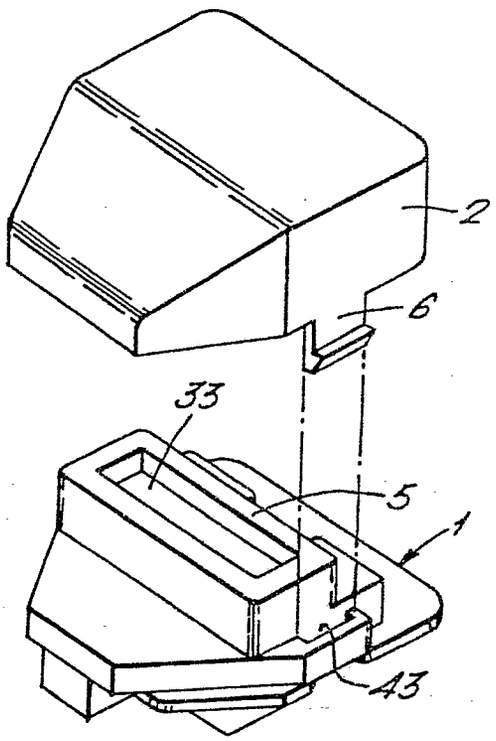

Fig. 4.

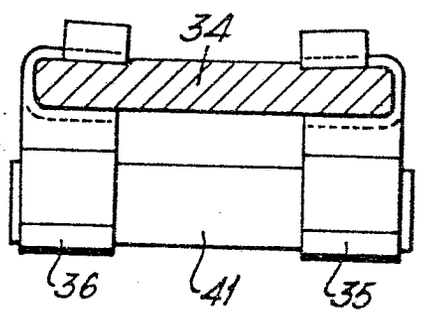

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Fig. 2.

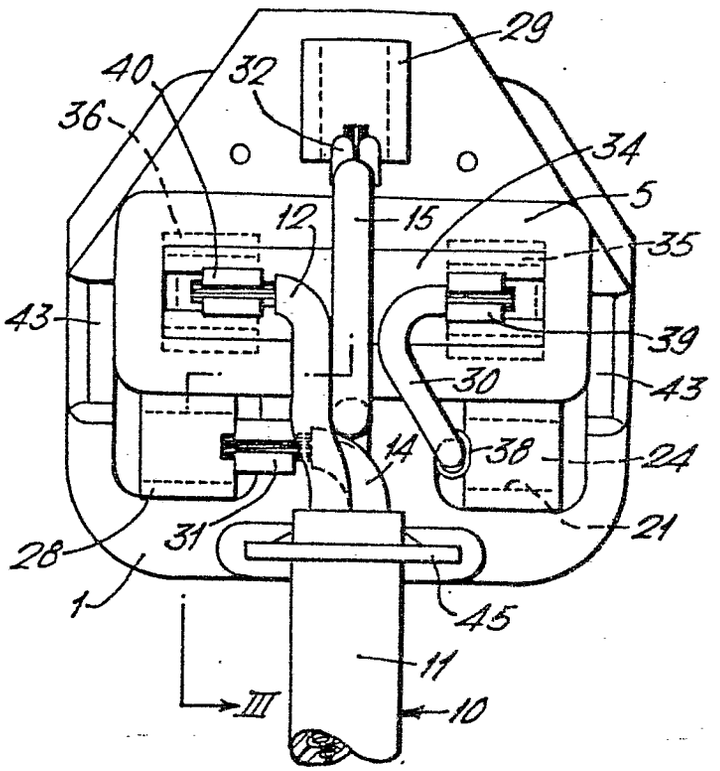

Fig. 3.

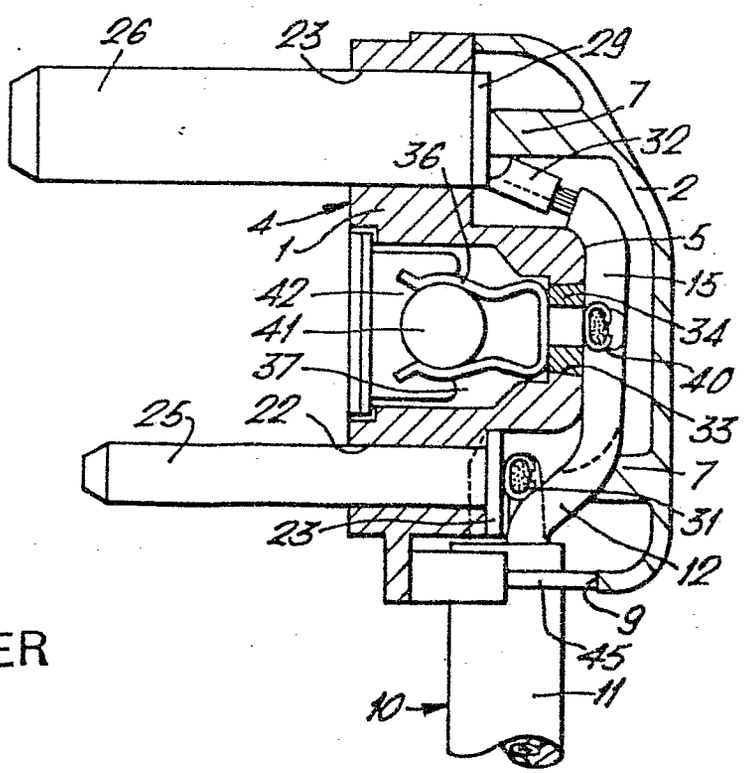

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Fig. 5.

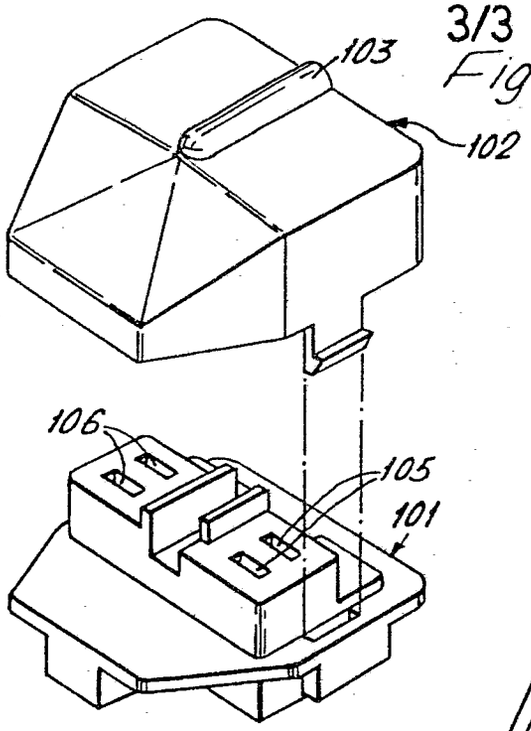


Fig. 6.

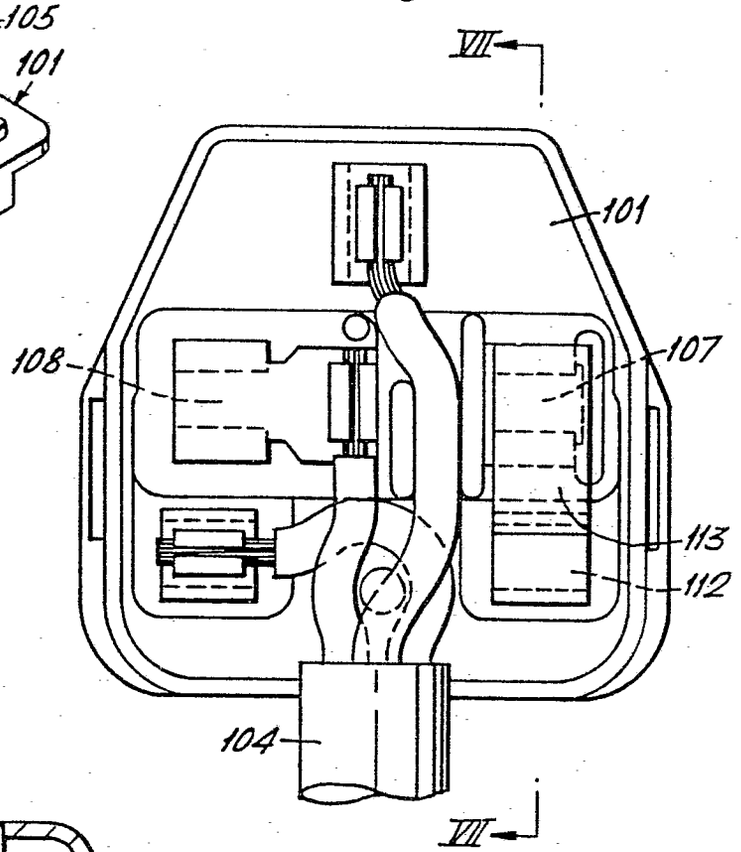
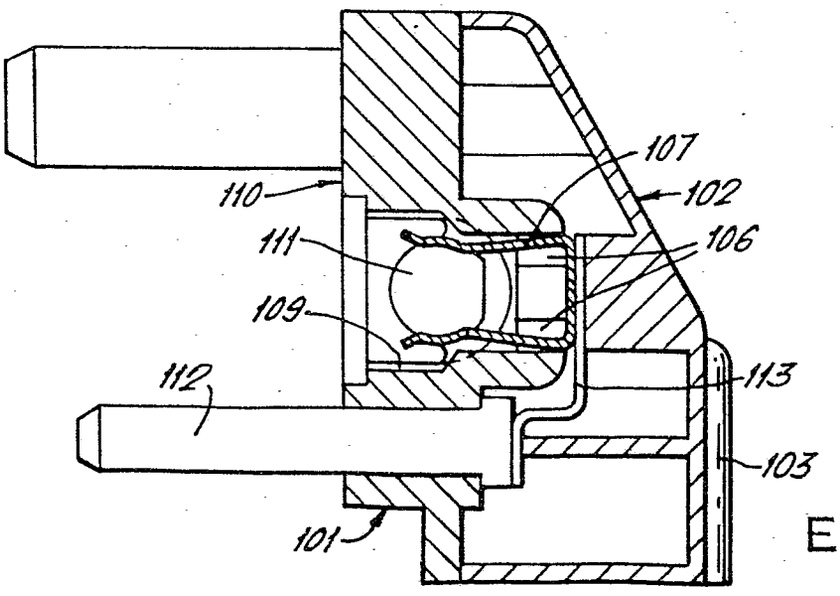


Fig. 7.



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EUROPEAN SEARCH REPORT

Application number

EP 79 300 431.8

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	DE- U - 6 803 416 (GREEN) * page 2, line 18 to page 5, line 10; fig. 1 to 3 *	1,2,6
	* page 4, lines 6 to 10; fig. 1 *	7,8
	-- US - A - 3 180 955 (H. HUBBELL et al.) * column 1, line 66 to column 2, line 23, column 2, lines 54 to 63; fig. 1 to 5 *	1
	* column 2, lines 24 to 47, column 2, line 54 to column 3, line 20; fig. 1 to 5 *	7,8
	-- DE - A1 - 2 707 442 (FELLER) * page 7, line 29 to page 9, line 26; fig. 1 to 3 *	7,8
	-- FR - A - 2 092 206 (FABBRICA MILANESE CONDUTTORI) * page 3, lines 9 to 16; fig. 1 and 2 *	9
	-- GB - A - 1 163 085 (PLESSEY) * page 2, lines 6 to 41; fig. *	4

CLASSIFICATION OF THE APPLICATION (Int. Cl.3)

H 01 R 19/12
H 01 R 13/68
H 01 R 13/46

TECHNICAL FIELDS SEARCHED (Int.Cl.3)

H 01 R 13/46
H 01 R 13/68
H 01 R 19/12

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Berlin	09-11-1979	HAHN

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