



(12) EUROPEAN PATENT APPLICATION

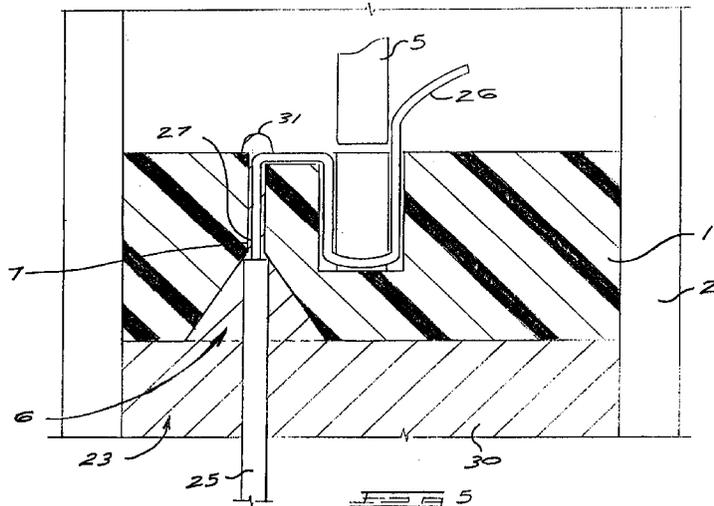
(43) Date of publication: 02.07.1997 Bulletin 1997/27  
(51) Int. Cl.<sup>6</sup>: H01R 23/66, H01R 9/07  
(21) Application number: 95309293.9  
(22) Date of filing: 20.12.1995

<p>(84) Designated Contracting States: <b>AT BE CH DE DK ES FR GB GR IE IT LI LU MC NL PT SE</b> Designated Extension States:</p> <p>(71) Applicant: <b>ALTECH INDUSTRIES (PTY) LIMITED</b> <b>Boksburg East, Transvaal Province (ZA)</b></p> <p>(72) Inventors: • <b>Willey, Christopher Anthony</b> <b>Johannesburg, Transvaal Province (ZA)</b></p>	<p>• <b>Richardson, Donald Charles</b> <b>Ballito, Natal Province (ZA)</b></p> <p>(74) Representative: <b>Bucks, Teresa Anne et al</b> <b>Boult, Wade &amp; Tennant</b> <b>27 Furnival Street</b> <b>London EC4A 1PQ (GB)</b></p> <p><u>Remarks:</u> Amended claims in accordance with Rule 86(2) for all contracting states</p>
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(54) **Electrical connector**

(57) An electrical connector has a base (1) with a row of conductor openings (5) through the base (1) and a slotted plug socket (8) in one base side parallel to the row. A plug (15) has conductive surfaces and is insertable into the socket (8) to wedge conductors against the

conductive surfaces. Conductor grooves (10,12) are provided in the slot at positions matching the conductive surfaces.



**Description****FIELD OF THE INVENTION**

This invention relates to an electrical connector, and more particularly an electrical connector which allows a sealed connection to be achieved.

**BACKGROUND TO THE INVENTION**

There are many different sealed systems for connecting electrical conductors together. In the application of electrical detonators, the connection of the conductors to the detonator is required to be sealed against water and moisture. In this regard, not only must the insulation around a conductor be sealed to the detonator housing, but the conductor itself must be sealed. If the insulation only is sealed, any leakage in the covering will allow moisture to enter underneath the insulator around the wire.

**OBJECT OF THE INVENTION**

It is an object of this invention to provide an electrical connector which can, inter alia, alleviate the above-mentioned difficulty.

**SUMMARY OF THE INVENTION**

In accordance with this invention there is provided an electrical connector comprising a base having a first and second side, with conductor openings through the base leading from the first to the second side, there being socket means in the second side spaced from the openings, and, a plug having conductive surfaces and being insertable into the socket to wedge a conductor therein in use against the conductive surfaces.

Preferably the openings are located in a row parallel with and spaced apart from a socket extending as a slit in the surface.

There is also provided for the openings in the first side to have a wide throat tapering to the normal opening diameter, and for there to be grooves in the second surface, extending from the openings across the surface, and into the socket, and to extend on opposite sides of the socket in the depth of the groove. It is provided for there to be a set of grooves in the socket for each of the openings.

Preferably the groove on one side of the socket is deep enough to fully receive the thickness of a predetermined size conductor, and the groove on the opposite side for the same socket is shallower, and sized to allow the predetermined conductor to protrude above the surface surrounding the groove in use.

**BRIEF DESCRIPTION OF THE DRAWING**

A preferred embodiment of the invention is described below by way of example only, and with refer-

ence to the accompanying drawings, in which:

Figure 1 is a diametrical cross-sectional view of a portion of a detonator housing fitted with a base according to the invention;

Figure 2 is an isometric view of a plug according to the invention;

Figure 3 is a top view of the base of the embodiment of Figure 1;

Figure 4 is an enlarged cross-sectional view of the base of Figure 1 showing a conductor being located therein with a plug in position for insertion, and

Figure 5 is an alternative embodiment of similar view to that of Figure 4.

**DETAILED DESCRIPTION OF THE DRAWINGS WITH REFERENCE TO THE DRAWINGS**

Referring to Figures 1 and 3, a base (1) is provided as part of an electrical connector, and is disc-shaped having opposing major circular surfaces.

One surface forms an entrance side (2) for cable conductors, and the other surface forms an opposing socket side (3).

Located in a row (4) are openings (5) extending axially through the disc from side to side. The openings on the entrance side (2) have a wide tapered throat (6) which narrows down to the normal opening diameter as indicated by numeral (7).

A socket (8) is rectangular in shape and located spaced apart but parallel to the row (4) of openings. The socket extends approximately halfway into the base in its depth. Each of the openings (5) has a groove (9) extending in the surface (3) from the opening to the socket. The groove is sized to receive a predetermined thickness of electrical conductor wire. The groove, on meeting the socket (8), extends downwardly into the socket depth axially in the orientation of the base, to the bottom. Located immediately opposite on the other side of the socket are matching groove sections (12). The groove (10) closest to the openings has a depth which is greater than the thickness of the intended conductor, and the groove (12) has a depth which is approximately half the thickness of the intended conductor.

Referring to Figure 2, a plug (15) for use with the base is a slab of generally rectangular configuration, and having a cross-sectional dimension enabling it to be plugged at one end (16) into the socket (8). On at least one of the major plug surfaces towards the end of (16), are located conductive strips (17) spaced apart from each other to align with the spacing of the grooves in the sockets. The conductive strips may be connected to whatever circuitry is required (not shown).

Referring to Figure 4, the base of Figure 1 together

with a plug as described with reference to Figure 2, is shown in enlarged cross-section. Like numerals used in the description of the reference to the previous sketches, indicate like elements.

In use, a conductor (20) being one conductor of a cable, and preferably a ribbon cable in this instance, is bared of its insulation and pushed through the openings (5) from the cable end (2). The wide throat (6) assists in guiding a row of such bared conductors into the openings (5). The ends protrude from the surface (3), and are bent over towards the socket to be located in the grooves (9) extending between the openings and the sockets.

The wires are then formed by a forming tool similar to the plug (15), into the grooves within the socket. By pushing the forming tool into the socket, the conductor is bent into the grooves (10) and (12) which correspond to the particular opening (5) for that conductor. The formed conductor is completely seated in the groove (10), but will project in its thickness from the groove (12) on the opposite side and furthest from the opening.

The plug (5) then may be inserted into the socket, with the conductive strip (17) facing the grooves (12). The strips contact the groove. Thus contact is made between the conductive strips and the conductors (20). The groove (10) allows the plug to slide into the socket without engaging the conductor on the side of the openings (5) and possibly shearing it.

Alternatively, both sides of the plug may have strips, and provision may be made for the wires to project to contact both sides of the plug.

The space between the surface (21) of the base and the surrounding housing (22) of a detonator (Figure 1) is then filled with an epoxy or other suitable sealant mixture, and the conductor wire itself as well as the insulation is then sealed to the detonator.

The electrical connection from the conductor to the relevant circuitry within the detonator is achieved from the plug in the base. This enables the final cable connection to be made with a reliable seal.

Referring to Figure 5, the disk (1) as described with reference to Figures 1 to 4 is located within the end of a tubular detonator housing (2), as described with reference to Figure 1. Like numerals in Figure 5 indicate like numerals as described with references to Figures 1 to 4. In this embodiment however, the conductor (25) has its insulation extending around the wire strand (26) of the conductor, all the way to apex (27) of the funnel shaped entrance (6) to the opening for the conductor.

It has been found in practice that it can be convenient sometimes to be able to insert the conductor through the opening (7), so that the insulation end abuts the apex of the funnel, since there is then no requirement for spacing the end of the insulation away from the disk.

However it is then more difficult to seal the incoming wire for the connector. Whilst any sealant located in the space (23) may seal around the insulation, it will not necessarily seal around the wire strand (26). Any open-

ing caused by a break in the insulation (25), allows moisture to be drawn up between the insulation and the conductor by capillary action and into the interior of the detonator.

In this embodiment, a sealant (30) is used which has a viscosity which enables the sealant to flow around the end of the insulation at the apex of the funnel, and down the opening (7). The viscosity is empirically chosen to enable this flow. The sealant drawn through the opening by capillary action forms a bead (31) at the other side, where it sets as the sealant hardens with time.

### Claims

1. An electrical connector comprising a base having first and second side, with conductor openings through the base leading from the first to the second side, there being socket means in the second side spaced from the openings, and, a plug having conductive surfaces and being insertable into the socket to wedge a conductor therein in use against the conductive surfaces.
2. An electrical connector as claimed in claim 1 in which the openings are located in a row parallel with and spaced apart from a socket extending as a slit in the surface.
3. An electrical connector as claimed in claim 2 in which the openings in the first side have a wide throat tapering to the normal opening diameter.
4. An electrical connector as claimed in claim 3 in which there are grooves in the second surface, extending from the openings across the surface, and into the socket, and extending on opposite sides of the socket in the depth of the groove.
5. An electrical connector as claimed in claim 4 in which there are two grooves running axially and diametrically opposite in each opening.
6. An electrical connector as claimed in claim 5 in which the groove on one side of the socket is deep enough to fully receive the thickness of a predetermined size conductor, and the groove on the opposite side for the same socket is shallower, and sized to allow the predetermined conductor to protrude above the surface surrounding the groove in use.
7. An electrical connector as claimed in any one of claims 3 to 6 in which conductors are sealed in position by a sealant located over the first side and within the tapering throat.
8. An electrical connector as claimed in claim 7 in which the sealant is an epoxy sealant.

9. An electrical connector as claimed in claim 7 in which the conductors have insulation extending into the throats of the openings, and are sealed in this position by a sealant which has been drawn into the normal opening diameter by capillary action.

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

1. An electrical connector comprising a base having first and second sides, with conductor openings through the base leading from the first side to the second side, there being socket means in the second side spaced from the openings and generally parallel to the openings, and, a plug having conductive surfaces and being insertable into the socket to wedge a conductor therein in use against the conductive surfaces.

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2. An electrical connector as claimed in claim 1 in which the openings are located in a row parallel with and spaced apart from a socket extending as a slit in the side.

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3. An electrical connector as claimed in claim 2 in which the openings in the first side have a wide throat tapering to a normal opening diameter.

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4. An electrical connector as claimed in claim 3 in which there are grooves in the second side, extending from the openings across the side and into the socket, and extending on opposite sides of the socket in the depth of the groove.

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5. An electrical connector as claimed in claim 4 in which there are two grooves running axially and diametrically opposite in each opening.

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6. An electrical connector as claimed in claim 5 in which the groove on one side of the socket is deep enough to fully receive a thickness of a predetermined size conductor, and the groove on the opposite side for the same socket is shallower, and sized to allow the predetermined conductor to protrude above surfaces surrounding the groove in use.

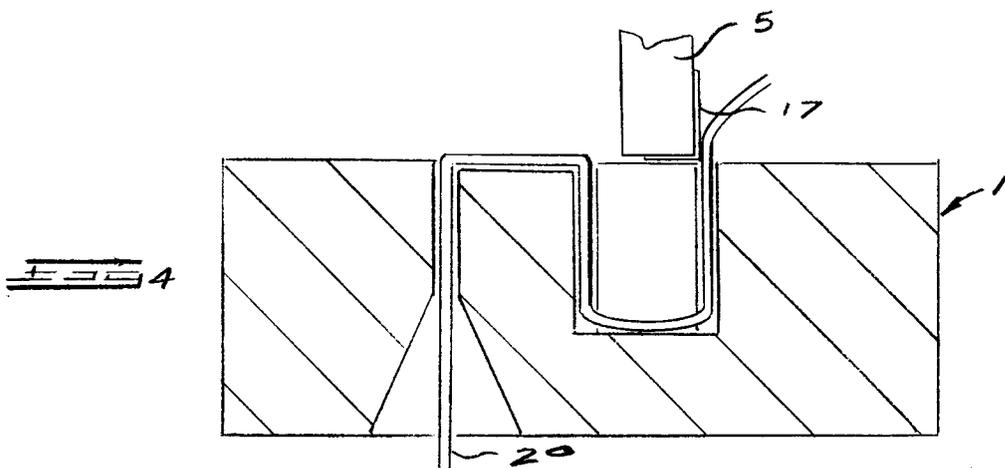
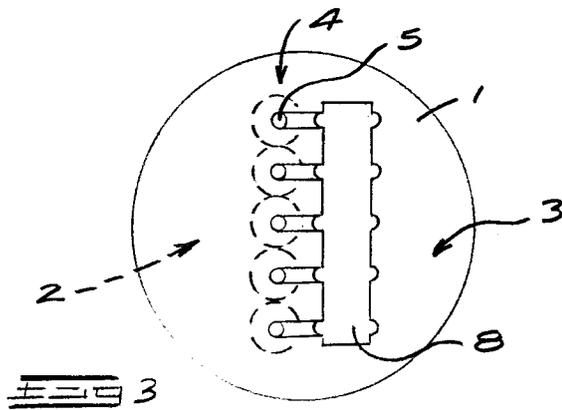
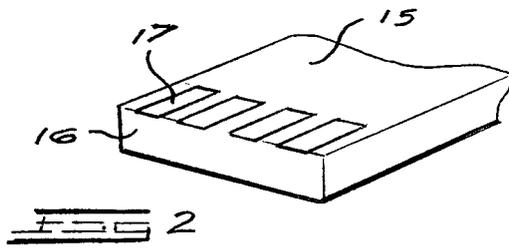
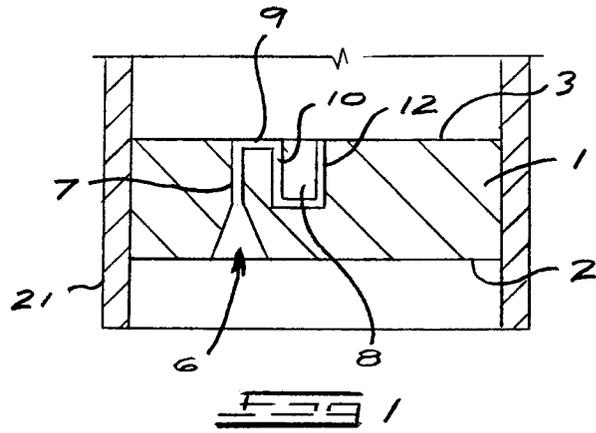
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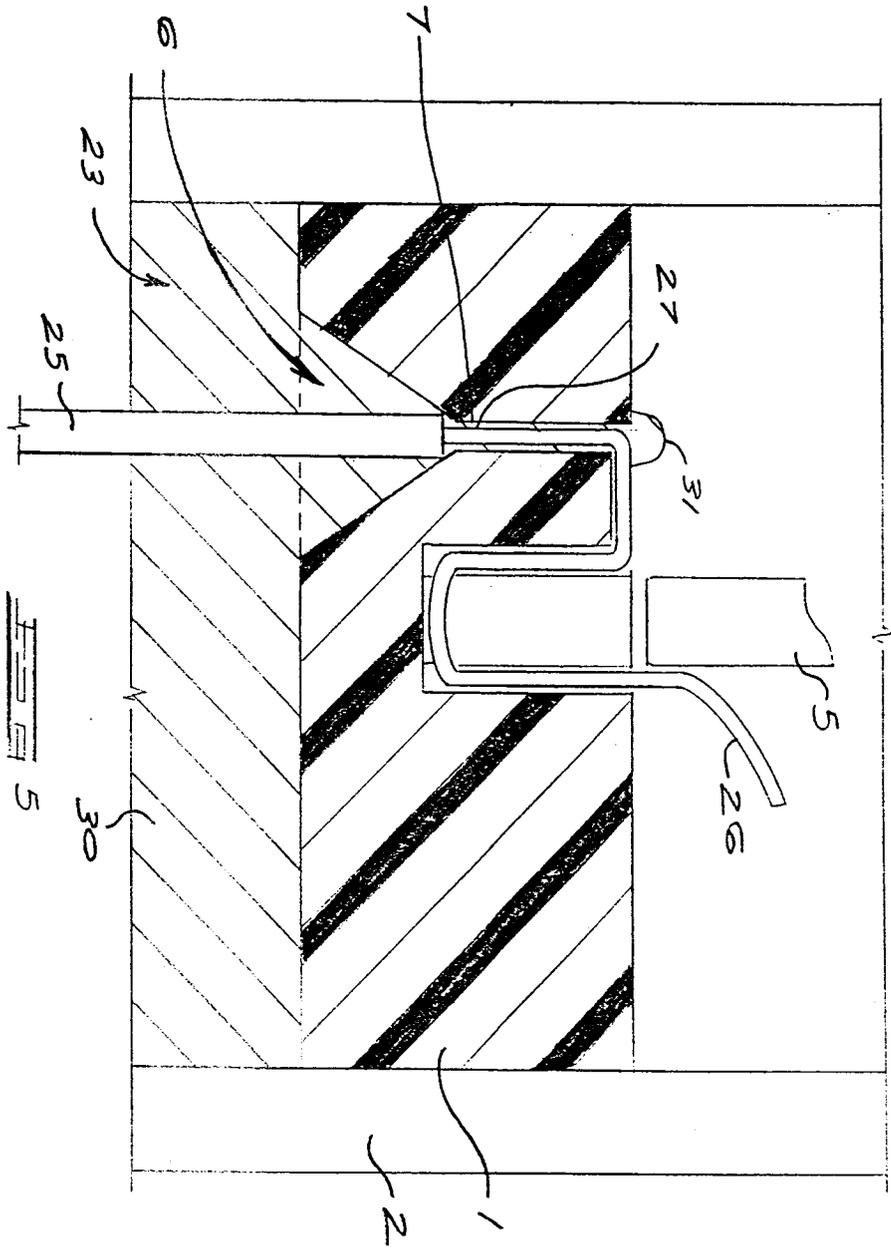
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7. An electrical connector as claimed in any one of claims 3 to 6 in which conductors are sealed in position by a sealant located over the first side and within the tapering throat.

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European Patent  
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EUROPEAN SEARCH REPORT

Application Number  
EP 95 30 9293

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	GB-A-2 170 961 (SUMITOMO ELECTRIC INDUSTRIES) 13 August 1986 * page 2, line 84 - line 101; figure 3 * ---	1,2	H01R23/66 H01R9/07
A	US-A-3 916 516 (HARMS WILLIAM J ET AL) 4 November 1975 * column 3, line 41 - column 4, line 10; figures 1-3 * ---	4-6	
A	US-A-3 670 290 (ANGELE WILHELM ET AL) 13 June 1972 * column 2, line 44 - column 3, line 28; figure 3 * ---	1-9	
A	US-A-3 082 398 (CHARLES F. VALACH) * column 3, line 44 - line 59 * * column 4, line 65 - column 5, line 8; figure 10 * -----	3,7-9	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			H01R
Place of search		Date of completion of the search	Examiner
THE HAGUE		3 May 1996	Criqui, J-J
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 01.82 (P04C01)