



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
18.04.2001 Bulletin 2001/16

(51) Int Cl.7: **H01R 9/05**

(21) Application number: **99120427.2**

(22) Date of filing: **14.10.1999**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE
 Designated Extension States:
AL LT LV MK RO SI

(72) Inventor: **Henningsen, Jimmy Ciesla**
4700 Naestved (DK)

(74) Representative: **Roerboel, Leif et al**
Budde, Schou & Ostenfeld A/S,
Vester Sogade 10
1601 Copenhagen V (DK)

(71) Applicant: **Cabel-Con A/S**
DK-4760 Vordingborg (DK)

(54) **Cable connector with reversibly compressible ferrule**

(57) The invention relates to a ferrule (10) of a cable connector where the ferrule (10) can be compressed around an electrical cable inside the connector and later released from said cable without appreciable irreversible deformation of the ferrule (10) so that this can be

reused a number of times. This characteristic of the ferrule (10) is obtained by providing the ferrule (10) with a number of narrow slots (28) in the circumferential wall (18) of the ferrule (10) providing the ferrule (10) with a form corresponding to an endless meander band.

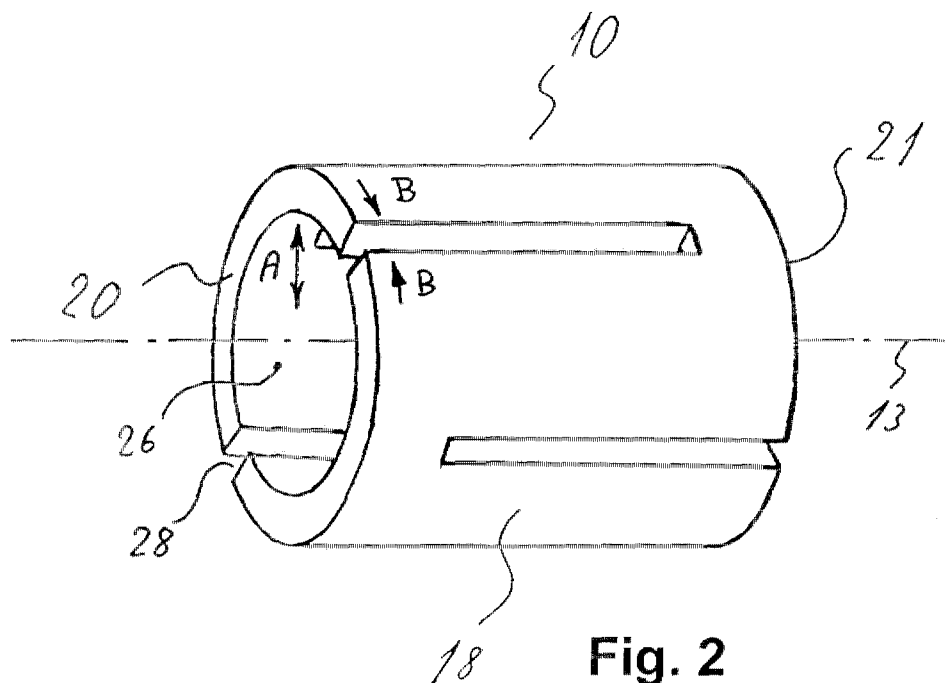


Fig. 2

Description

TECHNICAL FIELD

[0001] The present invention relates generally to a cable connector of the kind set forth in the preamble of claim 1 and more particularly to ferrules used in such connectors.

BACKGROUND ART

[0002] In cable connectors of this kind, it is known to use axially displaceable components with conical formations to provide the radial compression of a connection means such as a ferrule, to provide electrical and mechanical connection between the connector and the coaxial cable. The axial displacement of parts in the connector is effected by a bushing or collar provided with a thread which is screwed onto a corresponding thread provided on the main body of the connector.

[0003] A number of different designs of ferrules are known in the art. Thus, WO 97/22162 discloses a coaxial cable connector comprising a ferrule with a stepped cylindrical inner surface facing the shield and jacket of the coaxial cable and an outer surface facing radially displaceable parts of the connector, said outer surface being partly conical and engaging a corresponding conical inner surface on the connector such that a displacement of one part of the connector relative to another part thereof results in a general compression of the ferrule around the coaxial cable, thereby obtaining both electrical contact between the shield of the cable and the main body of the connector and mechanical attachment of the jacket of the cable and thereby the coaxial cable as such to the connector. The circumferential surface of the ferrule is continuous, i.e. not provided with slits through the cylindrical wall, and a compression of the ferrule around the cable as described above results in an irreversible deformation of the ferrule which hence can not be reused.

[0004] A connector for a coaxial cable is disclosed in FR 22 24 894, said connector comprising a ferrule, the cylindrical wall of which is split up axially over a part of the longitudinal extension of the ferrule. The inner surface facing the coaxial cable is essentially cylindrical, whereas a part of the outer surface is conical and in engagement with a corresponding part of the inner surface of the connector consisting of three parts which can be axially displaced relative to each other. An axial displacement of two of these parts relative to each other results in a compression of the split-up part of the ferrule around the coaxial cable, whereas the part at the ferrule that is not split up is not affected by the displacement of said two parts of the connector relative to each other.

[0005] EP 98119251.1 also describes a ferrule for a cable connector, where the ferrule as in the above-mentioned FR 22 24 894 is split up over a part of the longitudinal extension of the cylindrical wall, the other part of

the wall being of a fixed rigid configuration. The split-up part of the ferrule is formed to accommodate the difference between the outer diameter of the shield of the coaxial cable and the outer diameter of the jacket of the coaxial cable, although an optimal fitting of both shield and jacket imposes restrictions on the ratio between these outer diameters.

[0006] It is a disadvantage of ferrules of the kind described in the above-mentioned FR 22 24 894 and EP 98119251.1 that the split-up part of the ferrule after a compression thereof around the coaxial cable tends to have suffered from an irreversible compression so that it may be difficult to remove the ferrule from the cable and to reuse the ferrule, once it has been removed from the cable. Especially in connection with larger cable connectors and corresponding large ferrules the replacement of the ferrule is economically undesirable and reusability of the ferrule would thus be advantageous.

DISCLOSURE OF THE INVENTION

[0007] It is the object of the invention to provide a cable connector of the above kind comprising a ferrule which provides a firm and reliable electrical and mechanical connection between the shield of a coaxial cable and said connector and between the jacket of the coaxial cable and said connector, which is capable of accommodating a wider range of ratios between the outer diameter of said shield and said jacket and such that said ferrule can be compressed around said cable and then released from said cable without appreciable irreversible deformation of said ferrule, so that the ferrule can be reused a number of times.

[0008] These objects are achieved with a connector of said kind which in accordance with the present invention is characterised by the features set forth in the characterising clause of claim 1. According to the invention the objectives are met with the aid of a ferrule provided with means to ensure a reversible compressibility of the ferrule throughout its longitudinal extension, such that said compression can vary axially to accommodate variations in said outer diameters of the shield and jacket of a coaxial cable. Thus, for instance increasing the thickness of the wall of the jacket is made possible within certain limits, without deterioration of the electrical connection between the shield and the connector.

[0009] Preferred embodiments of the cable connector according to the invention are defined in the dependent claims 2 and 3.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The invention will now be described by way of example and with reference to the accompanying drawings, in which:

Figure 1 is a longitudinal, partially cross sectional

view of a cable connector with a coaxial cable inserted therein;

Figure 2 is a perspective view depicting the principle of one embodiment of a ferrule used in the cable connector according to Figure 1, and

Figure 3 is a side elevational view of an actual embodiment of the ferrule used in the cable connector according to Figure 1.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] A preferred embodiment of the cable connector for a coaxial cable according to the invention will now be described in detail with reference to Figures 1, 2 and 3.

[0012] Figure 1 shows a longitudinal, partially sectional view of a cable connector according to the invention. The connector 1 basically consists of two parts: the main body 2 of the connector and a bushing 3 to be screwed onto the main body 2 by means of threads 11, 12 provided on these two parts 2 and 3. Thus, an axial displacement of the bushing 3 relative to the main body 2 can be accomplished. A coaxial cable 5, 6, 7 and 8 is shown inserted into the connector, the conductor 5 of the coaxial cable being connected to the center terminal 4 of the connector via suitably designed resilient means 9 surrounding said conductor 5. A centering means 14 ensures the correct radial position of the insulator 6 of the coaxial cable in the connector 1. The coaxial cable comprises apart from said conductor 5 and said insulator 6 an electrically conductive shield 7 around the outer circumference of said insulator and an outer jacket 8 preferably made from a plastics material. The shield 7 is cut off at a position proximate to the end of the insulator 6 of the coaxial cable and the jacket is generally cut off at another position further away from the end of the insulator 6. A certain length of the shield and of the jacket is introduced into the intermediate region between said centering means 14 and a ferrule 10, said ferrule 10 providing both electrical connection between the shield 7 and the bushing 3 - and hence the main body 2 - of the connector, said bushing 3 and main body 2 being made from an electrically conductive material. The ferrule 10 generally has the shape of a hollow cylindrical tube with an inner surface 26 which as in the embodiment shown in Figure 1 can be provided with protrusions 27 providing electrical and mechanical contact between the shield 7 and the ferrule 10. Such protrusions could also be provided to secure a firm and reliable mechanical connection between the jacket 8 and the ferrule 10, although the embodiment shown in Figure 1 is not provided with such protrusions.

[0013] An axial displacement of the bushing 3 relative to the main body 2 as described above results in an engagement between a conical surface 24 on the main body 2 and a corresponding first conical surface 22 on one end of the ferrule 10. Similarly, an axial displacement results in an engagement between a conical sur-

face 25 on the bushing 3 and a corresponding second conical surface 23 on the end of the ferrule 10 opposite said first conical surface 22. The effect of these engagements is that when said bushing 3 is screwed onto said main body 2, the inner surface 26 of said ferrule 10, or at least a part/parts 27 thereof, are pressed radially against the shield 7 and /or jacket 8 of said coaxial cable to establish electrical connection between said shield 7 and said bushing 3, and such that when said bushing 3 is unscrewed from said main body 2, the inner surface 26 of said ferrule 10, or said part/parts 27 thereof, are released from its/their firm contact with said shield 7 and/or jacket 8, said ferrule 10 being constructed from such a resilient material and having such a form that after unscrewing said bushing 3 from said main body 2, the ferrule 10 returns to substantially the same overall shape and dimensions as its original shape and dimensions.

[0014] Figure 2 shows the fundamental construction of the ferrule 10 according to the invention. As shown the cylindrical wall 18 of the ferrule 10 is split up into a number of sections by means of longitudinally extending slots 28 extending from either end 20, 21 of the ferrule 10 over a longitudinal distance somewhat less than the total length of the ferrule 10, and such that one slot extends from one end (for instance 20) of the ferrule 10, the adjacent slot from the other end 21 thereof and so on. In Figure 2 the number of slots equals 4, but other numbers of slots may of course also be used.

[0015] The subdivision of the cylindrical wall of the ferrule 10 in the above manner results in that the wall takes the shape of an endless band or ribbon in the form of a meander pattern. The compression of the ferrule 10 resulting from the above described axial displacement of the main body 2 and the bushing 3 is brought about by a narrowing or widening of the slots 28, as indicated by the arrows B in Figure 2 and simultaneously by a radial displacement of the slotted ends of the ferrule 10 as indicated by the arrow A in Figure 2. Thus, radial compression and decompression of the ferrule 10 can take place over the whole longitudinal extension of the ferrule 10, although the largest amounts of compression and decompression can take place at the slotted ends of the ferrule 10.

[0016] An actual construction of a ferrule 10 according to this embodiment of the present invention is shown in Figure 3. The details of this ferrule corresponds to those shown in Figures 1 and 2 and will not be commented upon here.

[0017] In the above, the invention has been described in connection with a specific embodiment thereof, but it will, however, be clear for anybody skilled in the art that many modifications and variations can be made without departing from the scope of the invention as defined in the accompanying claims.

LIST OF PARTS**[0018]**

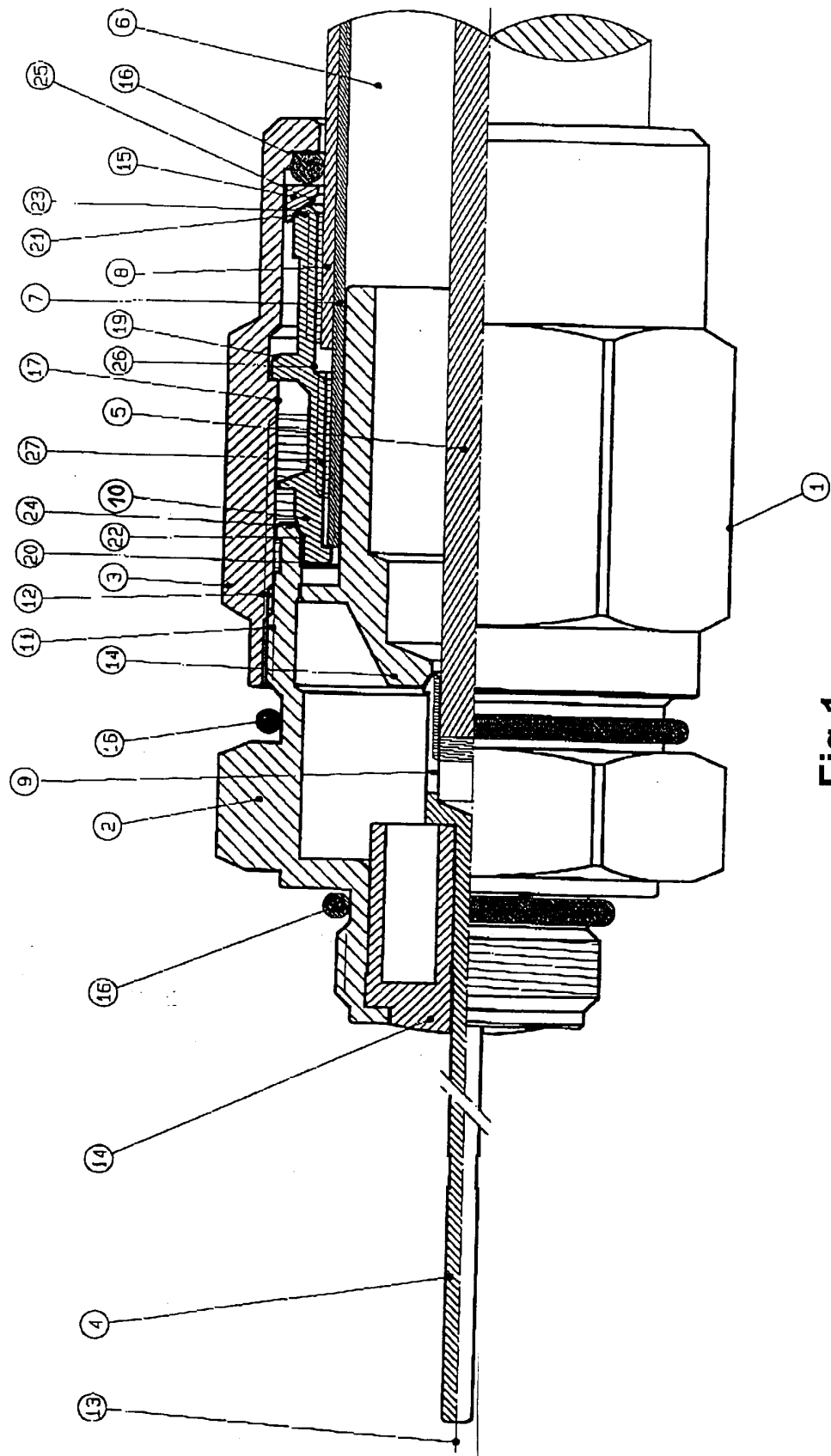
1	Cable connector	
2	Main body (of cable connector)	
3	Bushing (of cable connector)	
4	Center terminal	
5	Conductor of coaxial cable	
6	Insulator of coaxial cable	10
7	Shield of coaxial cable	
8	Jacket of coaxial cable	
9	Connection means	
10	Ferrule	
11	Thread on main body	15
12	Thread on bushing	
13	Longitudinal axis	
14	Centering means	
15	Ring	
16	Joint	20
17	Inner surface of bushing	
18	Circumferential wall of ferrule	
19	Outer circumferential surface of ferrule	
20, 21	End of ferrule	
22, 23	Conical portions of ferrule	25
24, 25	Portions corresponding to 22, 23	
26	Inner surface of ferrule	
27	Parts of inner surface of ferrule	
28	Longitudinal slots of ferrule	30

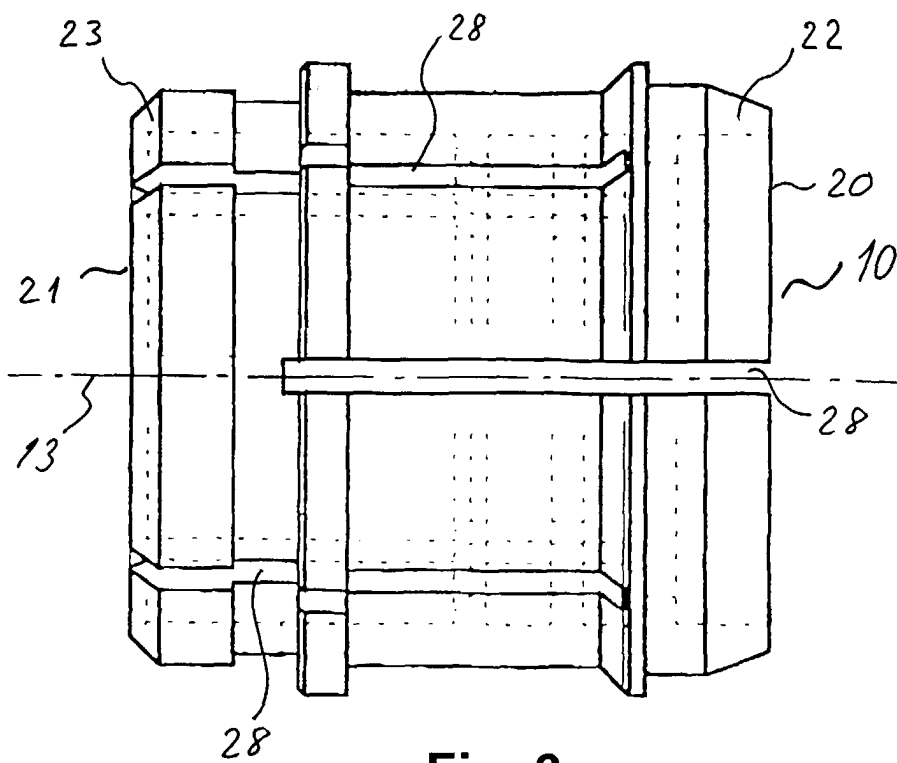
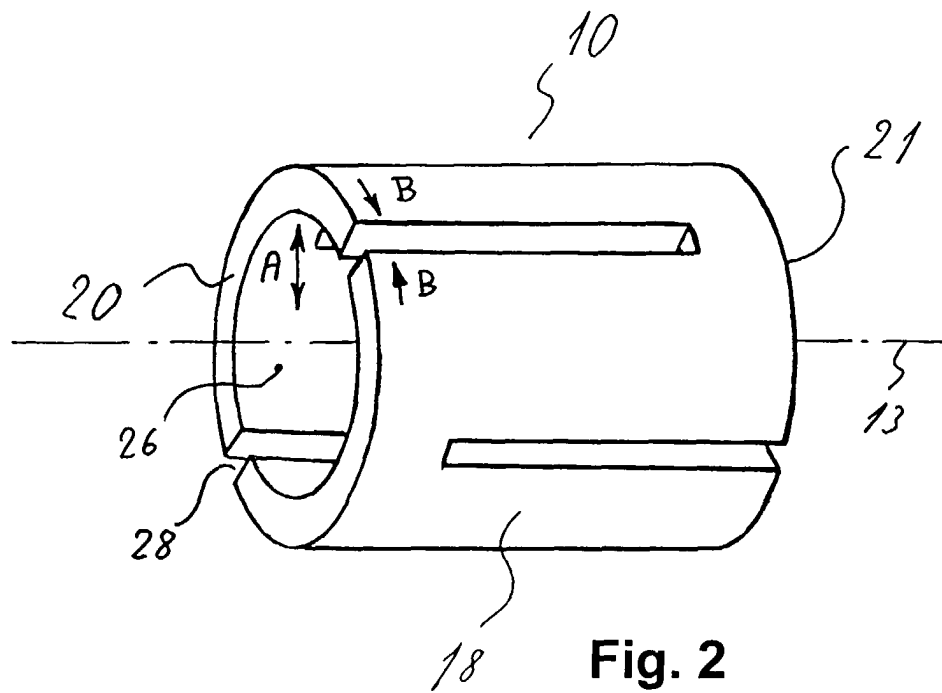
up from either end (20,21) such that said wall (18) obtains the form of an endless band or strip arranged in a meander form.

5 **3.** Cable connector according to claims 1 and 2, characterised in that
the outer circumferential surface (19) of said ferrule (10) at either end (20,21) is provided with conical portions (22,23) which can be brought into engagement with corresponding portions (24,25) placed on said main body (2) and said bushing (3).

Claims

1. Cable connector for coaxial cable, comprising a main body (2) and a bushing (3) for providing an axial displacement relative to said main body (2) of parts (10, 15, 16) in the connector, whereby the shield (7) and the jacket (8) of the coaxial cable is brought to a firm electrical and/or mechanical connection with the cable connector, where said displacement is accomplished by screwing a thread (12) on said bushing (3) onto a corresponding thread (11) provided on said main body (2), where said firm connection is obtained with the aid of a ferrule (10) at least partly made from an electrically conductive material and positioned between the inner surface (17) of said bushing (3) and the shield (7) and/or jacket (8) of the coaxial cable, characterised in that said ferrule (10) is reversibly compressible in the radial direction towards the longitudinal axis (13) of said coaxial cable throughout the whole longitudinal extension of said ferrule (10). 35 40 45 50
2. Cable connector according to claim 1, characterised in that said ferrule (10) has the form of a hollow, tubular body, the circumferential wall (18) of which is split 55







European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 12 0427

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.7)
X	US 5 773 759 A (HABLUETZEL RICHARD) 30 June 1998 (1998-06-30) * column 2, line 40 - line 59; figure 2 *	1-3	H01R9/05
A	US 3 907 399 A (SPINNER GEORG) 23 September 1975 (1975-09-23) * column 2, line 67 - column 3, line 25 * * column 3, line 41 - line 51 *	1-3	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			H01R
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 16 March 2000	Examiner Salojärvi, K
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 1523 03/02 (P04001)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 12 0427

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

16-03-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5773759 A	30-06-1998	AT 188315 T	15-01-2000
		DE 59604038 D	03-02-2000
		EP 0778644 A	11-06-1997
US 3907399 A	23-09-1975	DE 2260734 A	20-06-1974

EPO FORM P0459

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