PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :		(11) International Publication Number:
H01R 13/52, 9/05	A1	WO 92/16985
		(43) International Publication Date: 1 October 1992 (01.10.92)

(21) International Application Number: PCT/GB92/00467

(22) International Filing Date: 16 March 1992 (16.03.92)

(30) Priority data:
P 41 08 755.0 18 March 1991 (18.03.91) DE

(71) Applicant *(for MG only)*: RAYCHEM LIMITED [GB/GB]; Rolls House, 7 Rolls Buildings, Fetter Lane, London EC4A 1NH (GB).

(71) Applicant *(for all designated States except MG US)*: WALTER ROSE GMBH & CO. KG [DE/DE]; Profilstrasse 6-8, D-5800 Hagen 1 (DE).

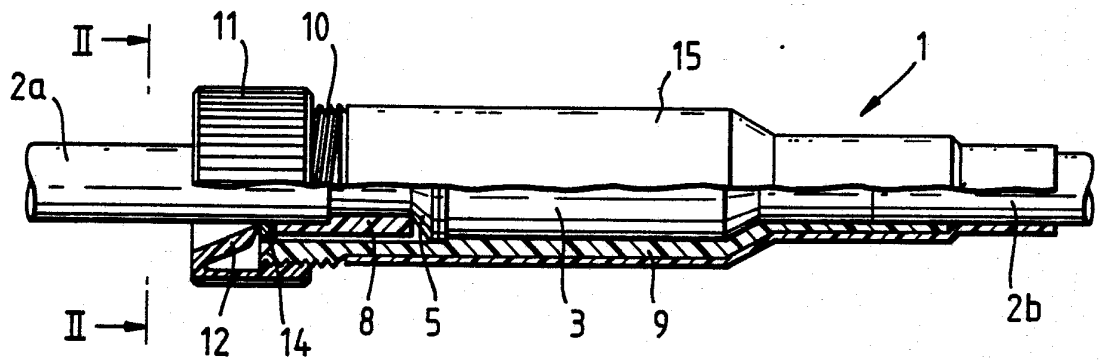
(72) Inventors; and
(75) Inventors/Applicants *(for US only)* : PAPENHEIM, Friedbert [DE/DE]; Dorotheenstr. 32, D-4750 Unna (DE). FEILER, Gerhard [DE/DE]; Wehringhauser Strasse 111, D-5800 Hagen 1 (DE).

(74) Agents: AUCKLAND-COOKE, Jacqueline et al.; Raychem Limited, IPLD, Faraday Road, Dorcan, Swindon, Wiltshire SN3 5HH (GB).

(81) Designated States: AT (European patent), BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), MC (European patent), MG, NL (European patent), SE (European patent), US.

Published
With international search report.

(54) Title: DEVICE FOR CONNECTING A COAXIAL CABLE END TO A CONTACT SOCKET



(57) Abstract

A device for connecting a coaxial cable end (2a) which may be provided with a cable end-plug (4) to a contact socket (3) comprises a further socket element (9) surrounding the contact socket (3), a seal (8) positioned between the further socket element (9) and the coaxial cable (2a), and a pressing element (11, 12) which can deform the seal into contact with the coaxial cable (2a) and the further contact element (9). The device provides both a good seal, and strain relief to the completed connection.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	**FI**	Finland	**ML**	Mali
AU	Australia	**FR**	France	**MN**	Mongolia
BB	Barbados	**GA**	Gabon	**MR**	Mauritania
BE	Belgium	**GB**	United Kingdom	**MW**	Malawi
BF	Burkina Faso	**GN**	Guinea	**NL**	Netherlands
BG	Bulgaria	**GR**	Greece	**NO**	Norway
BJ	Benin	**HU**	Hungary	**PL**	Poland
BR	Brazil	**IE**	Ireland	**RO**	Romania
CA	Canada	**IT**	Italy	**RU**	Russian Federation
CF	Central African Republic	**JP**	Japan	**SD**	Sudan
CG	Congo	**KP**	Democratic People's Republic of Korea	**SE**	Sweden
CH	Switzerland			**SN**	Senegal
CI	Côte d'Ivoire	**KR**	Republic of Korea	**SU**	Soviet Union
CM	Cameroon	**LI**	Liechtenstein	**TD**	Chad
CS	Czechoslovakia	**LK**	Sri Lanka	**TG**	Togo
DE	Germany	**LU**	Luxembourg	**US**	United States of America
DK	Denmark	**MC**	Monaco		
ES	Spain	**MG**	Madagascar		

Description

Device for connecting a coaxial cable end to a contact socket

The invention relates to a device for connecting a coaxial cable end to a socket, and also for connecting a coaxial cable end, that is provided with a coaxial cable plug at its end, to a contact socket that at least partially covers the plug. The device preferably also provides a sealed and strain relieved connection.

Various methods and devices are known for connecting coaxial cable ends to sockets, either for connecting coaxial cable ends to each other or for introducing coaxial cables into sockets in housings. In these known methods and devices efforts are made not only to ensure the electrical connection, but also to make the connection point as secure as possible. The known methods and devices for connecting coaxial cable ends to sockets include methods and devices in which the coaxial cables are provided at their ends with coaxial cable end-plugs. These end-plugs have standard sized outer dimensions which enable standard sized sockets to accommodate a variety of different diameters of coaxial cables, since the plugs can than be used to make a connection between coaxial cables of different diameters on which they are placed and a corresponding counter-element in a contact socket of standard size. The contact socket for the coaxial cable or end-plug may be provided either at another cable end or in a housing such as a distribution box or the like.

As examples of the known methods and devices, there may be mentioned EP-0 023 880-Al, DE-22 38 267-C3, DE-23 25 123-B2, DE-31 41 966-Al, DE-32 30 473-A, DE-35 11 039-Al or DE-35 12 952-Al of the Applicant.

Connection plugs for coaxial cables are also disclosed, for example, in DE-84 07 987-U1, DE-84 24 169-U1 or DE-82 19 184 of the Applicant, the latter disclosing, as does US-4 151 364, a double-action coupling element for the direct connection of two cable ends.

It is also known to provide seals in the connection region of coaxial cables. DE-36 07 451-Al of the Applicant, for example, discloses a coaxial cable end-plug in the form of connection body which can be placed over the

coaxial cable end. The connection body is provided with an outer seal for resting against the inner surface of a socket piece to which the coaxial cable is to be connected, and an inner seal for resting against an inserted coaxial cable.

The present invention addresses the problem of making a universal connection for a coaxial cable-end to a contact socket, in which connection cable-end plugs may or may not be used, while ensuring that an excellent seal and also some strain relief are achieved in the completed connection.

A first aspect of the present invention provides a device for connecting a cut-back coaxial cable to a contact socket into which the coaxial cable is inserted, the device comprising:

(i) a further socket element that can be positioned, in use, to surround the contact socket;

(ii) a seal extending at least part of the way between the end surface of the contact socket and the end of the cut-back insulation on the coaxial cable and

(iii) a pressing element which can act on the seal to deform the seal into contact with the inner surface of the further contact element and the outer surface of the inserted coaxial cable.

As used herein, the term a "cut-back coaxial cable" means a cable bared in the known standard way for connection to a contact socket or to another cable. A coaxial cable comprises an outer insulating jacket, an outer conductor, an intermediate insulating layer and an inner conductor. In a cut-back coaxial cable bared in the standard way, each of the layers surrounding the inner conductor is cut back increasingly larger distances from the end of the cable, to reveal a section of the layer underneath it. Thus a stepped configuration results in which the outer insulation jacket is cut back the furthest, and the inner insulating jacket the least.

The invention also provides a method of connecting a cut-back coaxial cable to a contact socket into which the coaxial cable is inserted, using a device according to the invention, the method comprising:

(i) positioning the device over the contact socket, and

(ii) activating or moving the pressing element so that it acts on the seal to deform the seal between the inner surface of the further contact element and the outer surface of the inserted coaxial cable.

Preferably the cut back coaxial cable end is provided with a coaxial cable-end-plug and the seal extends from the end face of the plug that is towards the inserted coaxial cable at least as far as the cut back insulation of the coaxial cable.

The pressing element acts on the seal to deform the seal into contact with the inner surface of the further contact element and the outer surface of the inserted coaxial cable. Preferably the pressing element acts on an end face of the seal (preferably the outer end face facing towards the inserted coaxial cable), compressing the seal longitudinally so that it expands radially into contact with the said surfaces. To this end the other end of the seal preferably presses against a stop so that action of the pressing element does not simply urge the seal along the inner surface of the further socket element. This stop may be provided, as a separate element or be part of other elements of the device of the invention. For example if a cable end plug is provided it may be a stop shoulder on that cable end plug. As another example the seal may abut against part of the contact socket into which the coaxial cable is positioned.

The provision of a seal positioned as defined, in conjunction with the provision of a pressing element that deforms that seal, has a number of advantages. In particular an optimum seal is formed between the further socket element and the outer surface of the coaxial cable, so that no moisture is able to enter the region between the contact socket and the coaxial cable.

In one embodiment of the invention a screw thread is provided on the further socket element, preferably on the outer surface thereof, preferably at the free end thereof, and the pressing element is in the form of a union nut having a screw thread that co-operates with the thread on the further contact element. In one embodiment the pressing element also comprises pressing webs which act on the end face of the seal. The arrangement is

preferably such that when the union nut is screwed onto the further contact socket the seal is simultaneously compressed longitudinally, by means of the pressing webs acting on the end face of the seal. The pressing webs may be integral with the union nut, or a separate part, for example webs depending from an annular ring. Where the webs are a separate part, this part may be urged longitudinally when the union nut is rotated, but not itself be rotated. The seal is thereby urged radially outward into sealing engagement with the further socket element and the coaxial cable end, i.e. into all free spaces in the coupling region of the coaxial cable in the contact socket.

In one preferred embodiment, the end surface of the further socket element slopes inwardly, thereby providing an inwardly directed continuous guide slope along which the pressing webs (that are preferably provided on the pressing element) can be guided. The pressing webs will thereby be guided to act laterally on the seal to compress it longitudinally, and will also be guided to press onto the outer surface (usually the plastics insulating jacket) of the coaxial cable.

In the preferred embodiment employing pressing webs acting on guide slopes at the end face of the further socket element, it is possible to arrange those pressing webs not only to compress the seal, but also at the same time to act as strain relief elements. This is achieved by arranging the pressing webs to point in a direction opposed to the direction of withdrawal of the coaxial cable, so that when a tensile strain is placed on the coaxial cable, withdrawal of the cable is substantially prevented by the pressing webs pressing onto the outer surface (usually the outer insulating jacket) of the coaxial cable.

In a particularly preferred embodiment involving the use of pressing webs, a thrust collar is preferably provided, which is arranged between the pressing webs and the seal so that the inner faces of the webs, towards the seal, act on the interposed thrust collar. In this manner it is possible to apply pressure to the entire outward facing surface of the seal, i.e. around a loop.

As stated above the pressing webs may be caused to press into the outer surface of the cables by acting on guide slopes on the end surface of the futher socket element. Instead of providing guide slopes on the further

socket element, similar guide slipes may be provided on a separate annular element positioned between the pressing webs and the seal. Where a thrust collar is provided the guide slopes may be provided on that collar, or on an additional element.

The contact socket into which the coaxial cable is inserted, and/or the further socket element, may be a coupling element at a free end of a second coaxial cable. The coupling element may, for example, couple the outer and inner conductors of the two coaxial cables. Alternatively the contact socket may comprise a cable entry pipe to a housing such as a distribution box or the like. The contact socket may form a mechanical coupling to the coaxial cable(s) or be heat recoverable, preferably heat shrinkable. Such contact jackets are well known and should be apparent to the man skilled in the art. The device of the present invention may include a contact socket as described herein.

The further socket element of the device of the invention, may be plastic. It can also be equipped with an external thread and/or can be heat shrinkable at least in regions, in order to facilitate connection to (e.g. shrinking down) onto the inserted coaxial cable end and/or onto a housing entry pipe or the like.

The invention is described in detail below, by way of example, with reference to the drawings, in which:

Fig. 1 is a partially cut-away view of two coaxial cables coupled to each other, in a position in which the two coaxial cable ends have not yet been secured to each other;

Fig. 2 is a view of the union nut shown in Figure 1 approximately along the line II-II of Fig. 1,

Fig. 3 is a view, corresponding to Fig. 1, of the coupling region in the secured position; and

Fig. 4 shows the free end of the coaxial cable end 2a of figures 1 and 3, that has been provided with a coaxial cable end-plug.

Referring now to all the figures, a device according to the invention, generally designated 1, for connecting two coaxial cable ends 2a and 2b comprises a coupling-like contact socket 3 on one coaxial cable end 2b, and a coaxial cable end-plug 4 on the other coaxial cable end 2a.

The coaxial cable plug 4 has at its one end towards the cable end 2a, a stop shoulder 5. This can be seen in Figure 4. A seal 8, shown here as a sealing composition sleeve, extends from the stop shoulder 5 as far as the cut back outer insulating jacket, designated 7, of the coaxial cable 2a.

The contact socket 3 is surrounded by a plastics socket element 9 which, in the coupling position, projects so far over the inserted coaxial cable end 2a that the sealing composition sleeve 8 is completely covered by the plastics socket element 9, as will be seen from Figures 1 and 2.

At its free end (towards coaxial cable 2a), the further socket element 9 has an external thread 10 over which an internally threaded union nut 11 engages.

The union nut 11 constitutes the pressing element of the invention and to that end is equipped with inwardly pointing, slightly inclined pressing webs 12. The webs 12 rest against inwardly directed guide slopes 13 on the free end surface of the socket element 9. Between the pressing webs 12 and the sealing composition sleeve 8 there is additionally provided an annular thrust collar 14 which rests against the end face of the sealing composition sleeve 8 facing out towards the coaxial cable 2a.

The mode of operation is as follows:

The coaxial cable end plug 4 is positioned on the cut-back coaxial cable end 21, and then pushed into the contact socket 3. The pressing element in the form of the union nut 11 is then screwed onto the external thread 10 of the further socket element 9. This causes the pressing webs 12 of the union nut 11 to press against the interposed thrust collar 14, i.e. to press in a direction to the right in Figure 1. As the pressing webs 12 move to the right the inward-end faces of the webs 12 come to rest against the guide slopes 13. As screwing of the nut continues, the guide slopes 13 guide the pressing webs 12, in a sliding manner, towards the outer jacket of the coaxial cable 2a, so

that not only is the thrust collar 14 pushed further to the right but also the free ends of the pressing webs 12 are pressed into the plastics insulating jacket of the coaxial cable end 2a, for example in the manner shown in Figure 3. This means that not only is a sealing action achieved by means of the seal 8, but simultaneously strain relief of the connection is achieved.

As shown in Figure 1 the further socket element 9 is surrounded by a piece of shrinkable tubing 15 and shrunk onto the coaxial cable end 2b. Instead the further socket element may itself be heat-shrinkable, at least in regions. A socket element 9a of that construction is shown in Figure 3, the region to be shrunk being shown by a dot-dash line.

The described exemplary embodiments of the invention can, of course, still be modified in various respects without departing from the basic concept. For example, instead of being in the form of a sealing composition, the seal may be constructed as a deformable cylindrical sealing pipe, as a corrugated sealing pipe, as a combination of cylindrical or round sealing rings and so on.

The invention similarly relates, of course, to the possibility of coupling in cases where a cable plug is not required. This is especially the case when the diameter of the coaxial cable to be coupled is sufficiently large to be pushed directly into the contact socket 3. In this case, the seal 8 is supported on the end face of the contact socket 3, and the mode of operation is otherwise the same.

Claims:

1. A device for connecting a cut-back coaxial cable (2a) to a contact socket (3) into which the coaxial cable (2a) is inserted, the device comprising:

(i) a further socket element (9) that can be positioned, in use, to surround the contact socket (3);

(ii) a seal (8) extending at least part of the way between the end surface of the contact socket (3) and the end of the cut-back insulation on the coaxial cable (2a) and

(iii) a pressing element (11,12) which can act on the seal (8) to deform the seal (8) into contact with the inner surface of the further contact element (9) and the outer surface of the inserted coaxial cable (2a).

2. A device according to claim 1, wherein the cut back coaxial cable end is provided with a coaxial cable-end-plug (4) and the seal (8) extends from the end face of the plug (4) that is towards the inserted coaxial cable (2a) at least as far as the cut back insulation of the coaxial cable (2a).

3. A device according to claim 1 or 2 characterised in that a thread (10) is provided at the free end of the further socket element (9) and the pressing element comprises pressing webs (12) which act on the end face of the seal (8) to effect the said deformation of the seal (8).

4. A device according to claim 3, characterised in that the free end of the further socket element (9) is provided with an inwardly directed sloping surface which acts as a guide slope (13), and the pressing webs (12) are pressable in sliding manner over those guide slopes (13) and onto the outer surface of the coaxial cable (2) to effect the said deformation of the seal.

5. A device according to claim 3, wherein an additional annular element

is provided, between the seal and the pressing webs, which annular element is provided with an inwardly directed sloping surface which acts as a guide slope, and the pressing webs are pressable in sliding manner over those guide slopes and onto the outer surface of the coaxial cable to effect the said deformation of the seal.

6. A device according to claim 3, 4 or 5, characterised in that the pressing element is in the form of a nut (11) provided with the said pressing webs (12), and the nut (11) can be moved relative to the further socket element (9), to cause the pressing webs to act on the end face of the seal.

7. A device according to claim 3, 4 and 5, charaterised in that the pressing element comprises, as separate parts, a nut and pressing webs, wherein the pressing webs are moved longitudinally to act on the seal, but are not rotated, when the nut is moved relative to the further socket element.

8. A device according to claim 6 or 7, characterised in that the further socket element is provided a screw thread on its outer surface which co-operates with internal screw threads on the nut (11) to effect the relative movement between the nut (11) and the further socket element (9).

9. A device according to any of claim 3 to 8, characterised in that the pressing webs (12) are arranged to point in a direction opposed to the direction of withdrawal of the coaxial cable (2a) and/or act at their inner face towards the seal (8) on an interposed thrust collar (14).

10. A device according to any preceding claims, characterised in that the further socket element (9) is in the form of an engagement coupling element at a free coaxial cable end (2b), or in the form of a cable entry pipe on a housing, preferably on a distribution box or the like.

11. A device according to any preceding claim, characterised in that the seal (8) comprises a sealing composition sleeve.

12. A device according to any preceding claim, characterised in that at

least parts of the further socket element (9) is formed of polymeric material.

13. A device according to claim 12, wherein at least part of the further socket element is heat recoverable, preferably heat shrinkable.

14. A device according to any preceding claim, comprising the contact socket (3).

15. A method of connecting a cut-back coaxial cable (2a) to a contact socket (3) into which the coaxial cable (2a) is inserted, using a device according to any preceding claim, the method comprising:

(i) positioning the device over the contact socket (3), and

(ii) activating or moving the pressing element (11,12) so that it acts on the seal (8) to deform the seal (8) between the inner surface of the further contact element (9) and the outer surface of the inserted coaxial cable (2a).

16. A method according to claim 15, wherein the coaxial cable is provided with a cable end-plug and the device is positioned so that the seal (8) extends from the end face of the plug (4) that is towards the inserted coaxial cable (2a) at least as far as the cut back insulation of the coaxial cable (2a).

Fig. 1.

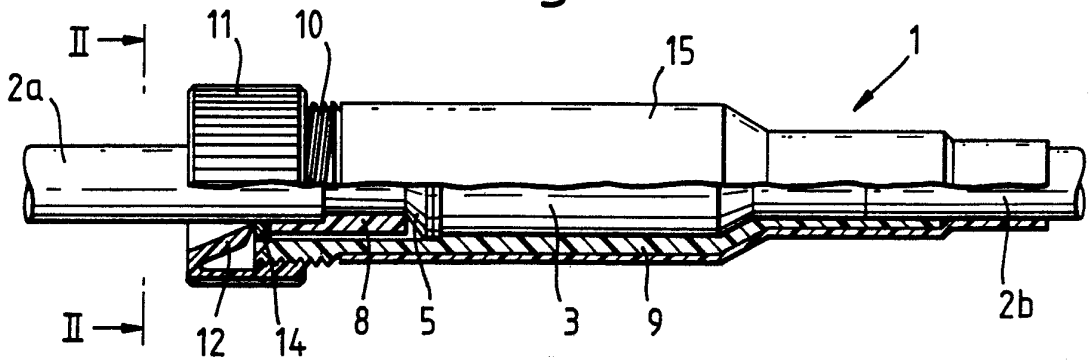


Fig. 2.

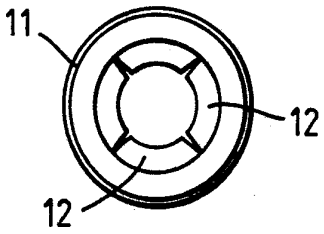


Fig. 3.

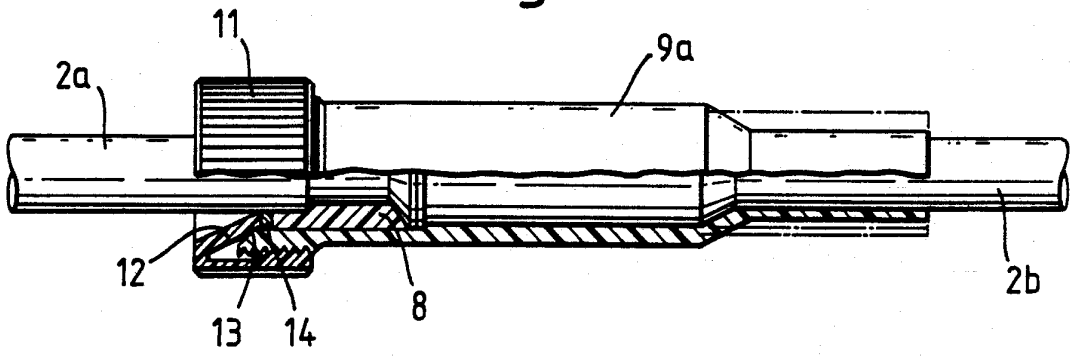
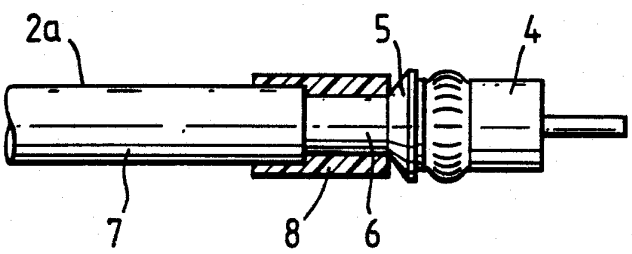


Fig. 4.



INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 92/00467

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 H01R13/52; H01R9/05

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	H01R ; H02G

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No.[13]
A	GB,A,2 177 552 (SPINNER GMBH) 21 January 1987 see abstract; figures 1,4	1,3,5-8, 14
A	US,A,3 761 870 (DREZIN ET AL.) 25 September 1973 see column 3, line 8 - line 31 see column 4, line 12 - line 20; figures 1,5	
A	US,A,3 936 124 (TUTTLE ET AL.) 3 February 1976 see column 3, line 67 - column 4, line 12; figure 4	1-3,5-8, 10,15
A	CABLES & TRANSMISSION vol. 22, no. 4, October 1968, pages 250 - 253; CAZAUX ET AL.: 'la paire coaxiale de 7/27mm' see page 252, line 18 - line 20; figure 6	1-3,14, 15

-/--

° Special categories of cited documents : [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
16 JUNE 1992	09. 07. 92
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	KOHLER J.W. Jarek W. Kohler

Form PCT/ISA/210 (second sheet) (January 1985)

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	US,A,3 985 950 (MALTZ) 12 October 1976 see abstract; figure 1	13

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. GB 9200467 SA 57536

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international 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. 16/06/92

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A-2177552	21-01-87	DE-C- 3522736	19-02-87
		AU-B- 596361	03-05-90
		AU-A- 5916086	08-01-87
		FR-A- 2583928	26-12-86
		US-A- 4687272	18-08-87
US-A-3761870	25-09-73	None	
US-A-3936124	03-02-76	None	
US-A-3985950	12-10-76	DE-A- 2406236	14-08-75
		BE-A- 815795	16-09-74
		FR-A,B 2260887	05-09-75
		GB-A- 1453809	27-10-76
		JP-C- 1137536	28-02-83
		JP-A- 55150571	22-11-80
		JP-B- 57031268	03-07-82
		JP-A- 50110094	29-08-75
		NL-A- 7409567	12-08-75