(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
24 January 2002 (24.01.2002)

PCT

(10) International Publication Number
WO 02/07281 A1

(51) International Patent Classification[7]: H02G 15/18, 1/14

(21) International Application Number: PCT/GB01/03149

(22) International Filing Date: 12 July 2001 (12.07.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0017340.1 15 July 2000 (15.07.2000) GB

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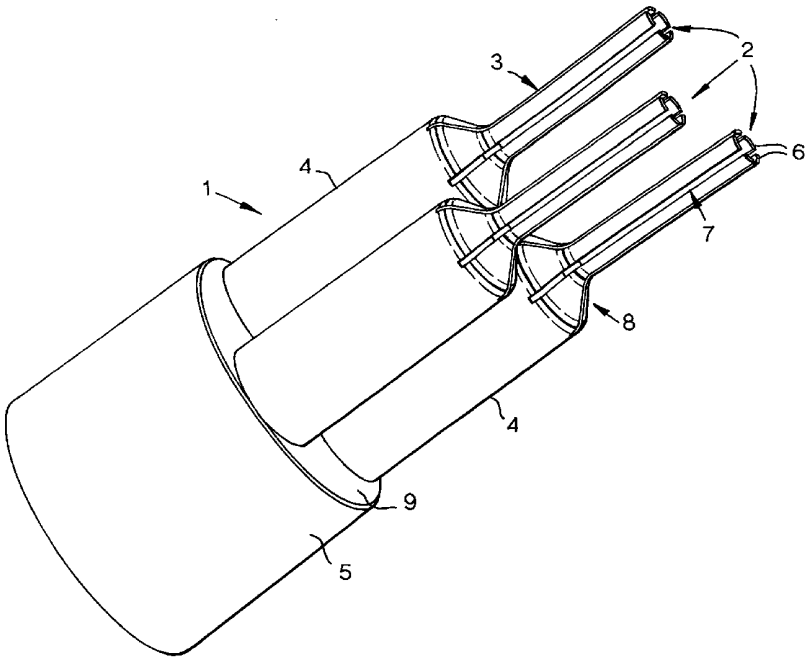
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE,

[Continued on next page]

(54) Title: MULTIPLE EXPANDER



(57) Abstract: A device (1) for applying radially expandable and recoverable sleeves (12) on elongate articles (11), such as cables, is arranged for expanding the sleeves (12) upon insertion of the elongate articles (11) into the device (1). The device (1) comprises two or more expandable substantially tubular sections (2) allowing two or more sleeves (12) to be expanded simultaneously.

WO 02/07281 A1

CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

Published:

— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

MULTIPLE EXPANDER

The present invention relates to a device for applying sleeves on elongate articles, such as cables or rods. More in particular, the present invention relates to a device for applying at least two radially expandable and recoverable sleeves on at least two substantially parallel elongate articles having an outer cross-sectional dimension greater than the largest inner cross-sectional dimension of each unexpanded sleeve, the device being arranged for expanding the sleeves.

The problem of expanding an elastic sleeve and applying it on elongate articles while expanded is well known. German patent DE 474 991 published in 1929 already provides a device for expanding elastic sleeves. This known device comprises a set of four tongues or "needles" which can be inserted into a sleeve and which can then be pushed apart by a hollow rod. A cable can then be passed through the rod and through the expanded sleeve held open by the needles. A disadvantage of this known device is that it consists of many parts, making it relatively expensive.

Another approach is disclosed in International patent application WO 89/00782 where it is suggested to insert a plurality of longitudinally extending rails into a sleeve to be expanded, after which a cable is pushed through the sleeve, the inserted rails allowing the cable to slide and thus expand the sleeve. A disadvantage of this approach is that a plurality of separate elements, that is the rails, have to be inserted into the sleeve prior to expansion and that it is difficult to control these elements during expansion. In addition, all these elements have to be removed when the sleeve has been applied.

European patent application EP 0 815 624 proposes to mutually connect the sliding elements by a cross-strap, thus making it easier to insert and remove the elements.

When using any of the above devices for applying a number of sleeves over several parallel elongate objects, a number of individual devices must be used, thus increasing the number of components involved in installing sleeves. Also when installing an end cap for a cable branch, the end cap having several sleeves extending from a common body, it is

necessary to use several prior art devices. This makes the installation of such an end cap relatively complicated.

It is an object of the present invention to eliminate these and other disadvantages of the prior art and to provide a device for applying sleeves onto elongate articles, which device allows two or more sleeves to be applied simultaneously.

It is another object of the present invention to provide a device for applying one or more sleeves on elongate articles, which device consists of a minimum number of components, preferably only a single component.

It is a further object of the present invention to provide an integral device for applying an end cap on a cable branch having several sleeves.

It is a yet further object of the present invention to provide a method for substantially simultaneously applying two or more elastic sleeves on elongate articles.

To meet these and other objects, a device as defined in the preamble is according to the present invention characterised in that the device comprises at least two expandable tubular sections.

By providing at least two expandable sections, a single structure is obtained which can easily be handled. In particular, the number of tools necessary for applying the sleeve is significantly reduced.

In an advantageous embodiment of the present invention the expandable sections are integral with a common base. Although the device of the present invention could be assembled from several separate parts, an integral structure is inexpensive to manufacture and easy to use.

The expandable sections may be substantially parallel. However, this is not necessary and in a particularly advantageous embodiment the expandable sections may be bent in a

desired direction. For this purpose, the common base of the expander sections may be flexible.

The device of the present invention may be made of, for example, polethylene, polypropylene, polycarbonate, thermoplastic elastomers, or a combination thereof.

The present invention further provides a method of applying two or more elastic sleeves on elongate objects, which method is characterised by the use of a device as defined above. Advantageously, the sleeves are integral parts of an end cap for a cable splice.

The present invention additionally provides a method of applying an elastic sleeve on an elongate object using a device having an expandable section , wherein the device is inserted into the sleeve and the elongate object is inserted into the device , which method is characterised by leaving the device in the sleeve after the application thereof. It is noted that the Prior Art referred to above stipulates that the device be removed from the sleeve after recovery. This further aspect of the present invention is based upon the insight that in many applications the device can be left in the sleeve or sleeves. Such a "disposable" device can be a device as defined above, but may also be a conventional device having only a single expandable section. In this respect it is immaterial whether the expandable section consists of a set of fingers, an expandable tube or any other means.

The present invention will further be explained with reference to exemplary embodiments illustrated in the accompanying drawings, in which:

Figure 1 schematically shows, in perspective, a first embodiment of the device according to the present invention;

Figure 2 schematically shows, in perspective, the embodiment of Fig. 1 as applied in a (partically cut-open) cable break-out cap.

The device 1 as shown by way of non-limiting example in Fig. 1 comprises a base 9 from which three expander units 2 extend. Each expander unit 2 comprises a widened part 4 and an expandable section 3. In the embodiment shown, each expandable section 3 consists of five flexible fingers 6, separated by slits 7. The fingers 6 are integral with a widened part

(connecting part) 4 which is substantially tubular. In a transition area 8 a smooth transition is made from the larger diameter of the widened part 4 to the smaller diameter of the expandable section 2. The base 9 is provided with a collar 5.

The three widened parts 4 are, in this particular embodiment, integral with the base 9 and the substantially tubular collar 5. The device 1 shown in Fig. 1 therefore consists of a single piece.

It is also possible for the device 1 to consist of several assembled pieces. It is advantageous for the collar 5 to be rigid to facilitate the handling of the device. On the other hand it is particularly advantageous for the base 9 to be flexible so as to allow the angles of the expander units 3 to be adjusted relative to each other and/or to the collar 5. The base 5 is therefore preferably made of a flexible material, such as a (thermoplastic) elastomer. The expander units 2 may be wholly or partially made of a flexible or relatively rigid material. However, the expandable sections 3 (fingers 6 in Fig. 1) should of course be flexible enough to allow an easy expansion.

In the partially cut-open view of Fig. 2 it is shown how the device 1 of Fig. 1 may be inserted in a set of sleeves for a cable break-out. The sleeves 12 are integral with a cap 13 which is made of an elastic material, such as natural or synthetic rubber. The cap 13 is shown folded back over the collar (5 in Fig. 1) of the device 1. A ring 14 is attached to the collar and provides additional strength.

The device 1 is designed so as to be easily insertable into the cap 13 in its unexpanded state. When inserted, a cable branch may be inserted into the device which then slides over the surface of the inserted cables, thereby expanding the sleeves 12.

According to a further aspect of the present invention, the device 1 may not be removed from the sleeves 12 after installation but may remain in the sleeves. This eliminates the step of removing the device 1 from the sleeves, thus making the installation thereof simpler and quicker.

The device 1 may advantageously be used together with one or more expander tubes (not shown) for effecting pre-expansion of the sleeves 12. Such expander tubes are inserted into the device when it is, in turn, inserted in the sleeves. At a later stage cables or rods on which the sleeves are to be applied are inserted into the expander tubes which are subsequently removed.

In the embodiment shown the device 1 comprises three substantially parallel expander units. Other numbers of expander units are equally well possible, such as two, four, five, six or an even greater number. Also, the device 1 may be designed in such a way that the expander units are not parallel but under an acute angle, for example. In addition, the device 1 may consist of several assembled parts instead of having a unitary, integral structure.

Further advantages may be achieved according to the present invention by providing the fingers or other longitudinal elements with at least one substantially concave side.

By providing longitudinal elements having a concave side, it is possible to apply a lubricant on said side without it being immediately removed by any sliding motion. The lubricant is substantially contained between the resulting longitudinal protrusions and will lubricate over substantially the entire length of the sleeve. In this way, the friction is considerably reduced and removal of the device after application of a sleeve using the device is greatly facilitated, in cases where it is not desired to leave the device in the installed sleeves.

In an advantageous embodiment the longitudinal elements are substantially flat, that is, the elements have a substantially rectangular or oval basic cross-section, at least one side being at least slightly concave to carry any lubricant. Preferably both sides of the elements are concave to facilitate their use and to eliminate any erroneous use.

The elements may be mutually connected to constitute a single, possibly even integral device. However, it is also possible for the elements to constitute separate parts.

This aspect of the present invention will now further be explained with reference to the accompanying Figure 3 in which the sliding elements 3 shown merely by way of non-limiting example have an approximately rectangular cross-section. However, the "outer" surface is shown to be concave, while the "inner" surface is shown to be substantially flat. The terms "inner" and "outer" refer to the substantially circular arrangement of the sliding element 3 within the sleeve (not shown) in use, the "outer" surfaces facing the inside of the elastic sleeve.

As shown, the concave shape of the outer surface results in protrusions 6 to extend along the length of each element 3. Lubricant (not shown) may be applied to facilitate the insertion of the device into, and the removal from the sleeve. Thus, the lubricant is laterally contained by the protrusions 6.

In addition, the protrusions 6 take up some of the pressure exerted by the sleeve, thus preventing the lubricant from being squeezed from the element 3.

It will be understood that instead of a curved, concave outer surface a substantially straight surface having upstanding protrusions (18 in Figs. 1 and 2) could be used with the same or a similar effect, and is therefore included in the term "substantially concave".

Although elements 3 may be separate, they are advantageously combined into a single, possibly even integral device. An example of such a device is shown in Fig. 3. This device 1 comprises a flexible tubular expander element 2 having reinforcement ribs 3 which are substantially concave on the outside of the tubular expander element. Such an embodiment has the advantage that the spacings between the sliding elements 3 are well defined and that the sliding elements 3 cannot overlap under high pressure.

When individual sliding elements 3 are used (mutually connected by a connecting element such as a ring) care should be taken to avoid any overlapping of the sliding elements 3 upon expansion of the sleeve.

It will be understood by those skilled in the art that the present invention is not limited to the embodiments shown and that many additions and modifications are possible without departing from the scope of the present invention as defined in the appending claims

Claims

1. Device (1) for applying radially expandable and recoverable sleeves (12) on elongate articles (11) having an outer cross-section greater than the largest inner cross-sectional dimension of the unexpanded sleeves (12), the device (1) being arranged for expanding the sleeves (12),
characterised in that the device (1) comprises at least two expandable substantially tubular sections (2), integral with a common base (9).

2. Device according to claim 1, wherein the expandable sections (2) are substantially parallel.

3. Device according to claim 1, wherein the expandable sections (2) can be made to point in different directions.

4. Device according to any of the preceding claims, having three expandable sections (2).

5. Device according to any of the preceding claims wherein at least one expandable section (2) comprises a plurality of fingers (6) extending from a connecting part (4).

6. Device according to any of claims 1-4, wherein at least one expandable section (2) comprises a tubular body having a substantially uninterrupted circumference.

7. Device according to any of the preceding claims, made of polyethylene, polypropylene, polycarbonate and/or a thermoplastic elastomer or a combination thereof.

8. Device according to any of claims 1-6, made of reinforced paper.

9. Device according to any of the preceding claims, characterised by fingers or other longitudinally extending elements having at least one substantially concave surface to accommodate a lubricant in a position to lubricate the removal of the sleeve when present.

10. Method of applying two or more elastic sleeves (12) on elongate objects (11), **characterised by** the use of a device (1) according to any of the preceding claims.

11. Method according to claim 10, wherein the sleeves (12) are integral with a cap (13).

12. Method of applying an elastic sleeve (12) on a cable or other elongate object (11) using a device (1) having an expandable section (2), wherein the device (1) is inserted into the sleeve (12) and the elongate object (11) is inserted into the device (1), **characterised by** leaving the device (1) in the sleeve (12) after the application thereof.

13. Method according to claim 12, wherein the device (1) is a device according to any of claims 1-9.

14. Method according to claim 12, wherein the device (1) has only a single expandable section (2).

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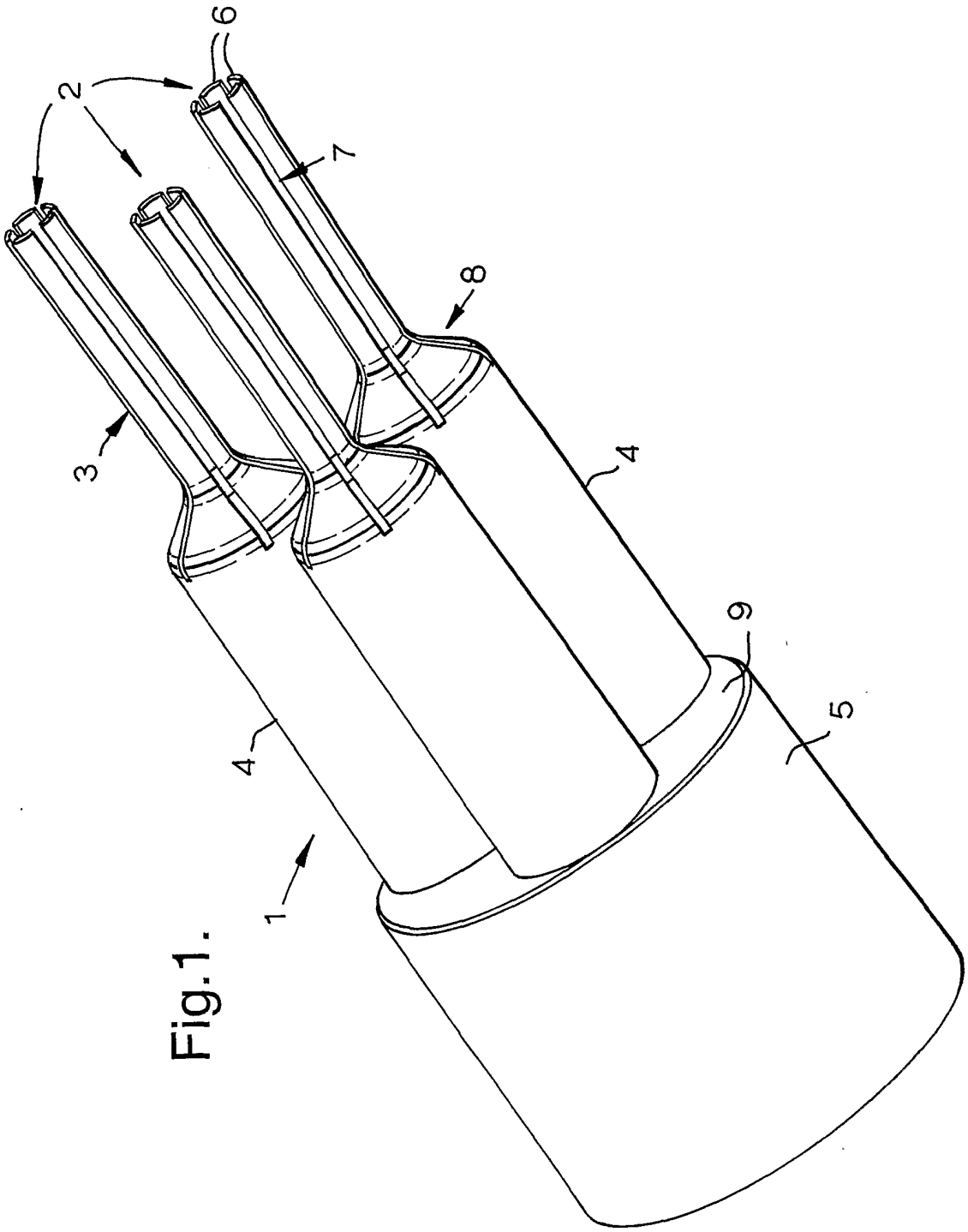

Fig.1.

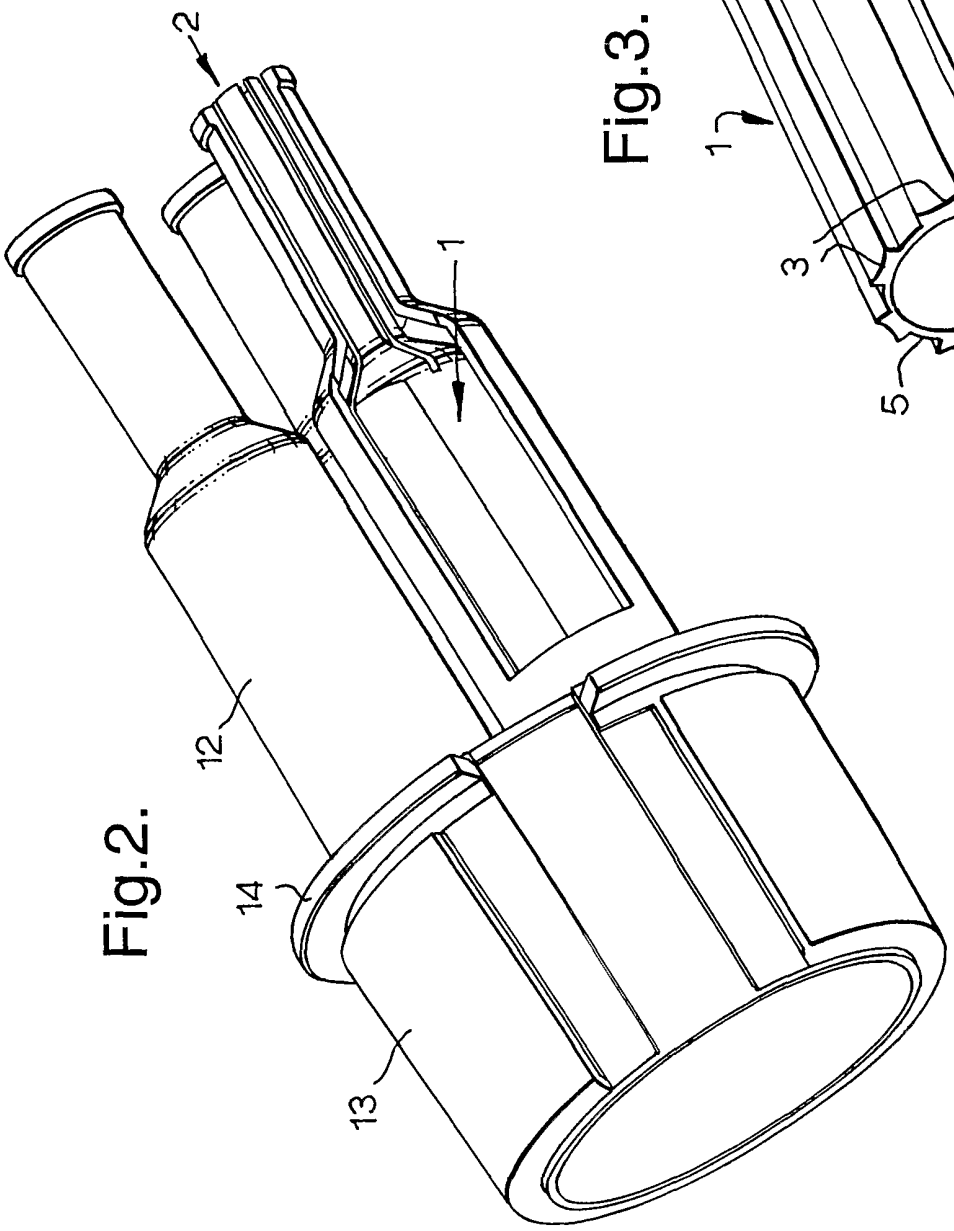

Fig.2.

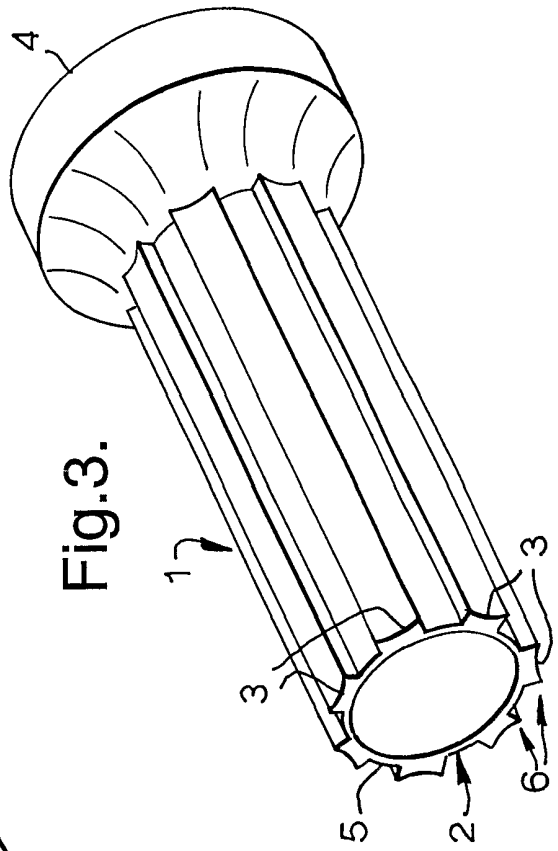

Fig.3.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 01/03149

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H02G15/18 H02G1/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H02G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

WPI Data, PAJ, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 96 29767 A (HAIM KLAUS DIETER ;ROTZSCHE RALF (DE); WEICHOLD JENS (DE); PILLING) 26 September 1996 (1996-09-26) cited in the application page 9, line 19 -page 12, line 34; figures 1A,1B	1,5, 12-14
A	DE 198 07 840 A (ZITTAUER KUNSTSTOFF GMBH) 26 August 1999 (1999-08-26) column 3, line 47 -column 4, line 14; figures 1-4	1,5, 12-14
A	DE 474 991 C (SCHLAMP) 28 March 1929 (1929-03-28) cited in the application	

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

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

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 September 2001	27/09/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Lommel, A

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 01/03149

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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