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(54) **Method for accessing optical fibers contained in a sheath**

Zugangsverfahren für optische Fasern in einem Mantel

Procédé d'accès à des fibres optiques dans une gaine

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Description

Field of the Invention

[0001] The present invention relates to optical fiber telecommunications cables. More particularly, the present invention relates to a method for accessing an optical fiber in a sheath typically disposed in a telecommunications cable.

Description of the Prior Art

[0002] The method as disclosed in the preamble of claim 1 is known from U.S. patent No. 4,859,020. In addition, WO 97/42694 relates to a method for the manufacturing of cable branches in which the cable casing is removed along a portion of the cable and a circular cut is made in the cable housing.

[0003] Telecommunication cables employing optical fibers are widely used in the telecommunications industry because such optical fibers provide relatively wide bandwidth and low noise operation. Telecommunications cables employing multiple optical fibers are used for a variety of applications including long distance telephone communications, interexchange telephone applications, and other telephony and data transmission applications. Cables containing multiple optical fibers are also being used by cable television networks in the place of traditional coaxial cables containing metallic conductors to provide the bandwidth necessary to support services such as near real-time, on-demand video to the home.

[0004] A typical optical fiber cable is formed by one or more cores which contains a plurality of optical fibers and an outer protective jacket surrounding the one or more cores. There are numerous issued U.S. patents that describe various, specific configurations for such cables. In a typical commercially available loose-tube type optical fiber cable, a series of plastic buffer tubes or sheaths are stranded around a central support member in one or more concentric layers. In most commercially available cables, the plastic buffer tubes are provided with a unique color for identification purposes. Also, each of the fibers in a buffer tube are provided with a unique color-coded coating thereon to enable identification of a particular individual fiber from the other fibers within a colored buffer tube of the cable. The color-coding scheme is important when fibers are to be dropped out of the cable to provide a local optical fiber branch.

[0005] Cables which are useful in the cable television field typically have a relatively small number of grouped fibers, typically three or four fibers, which are identified, accessed and connected at a drop point. In addition, a large number of spaced apart drop points are typically provided along the length of the cable to enable fibers to be dropped, as required. When a fiber is to be dropped, access to a fiber protected by one of the buffer tubes in the cable is made at a drop point. Typically, access is made by cutting into the outer jacket and using buffer

tube cutting or slitting tools to remove a portion of the buffer tube. The use of such tools is necessary for some cable designs because the buffer tube material is tough. On the other hand, some buffer tube or sheath materials are relatively soft and tools are not required. Whether a buffer tube slitting tool is necessary or not, it is important that during the procedure of accessing an optical fiber, other optical fibers are not damaged. Also, once the optical fiber is accessed, it is important to protect the remaining optical fibers in a manner similar to the type of protection provided by the buffer tube. Because the prior methods for accessing the optical fibers typically remove a portion of the buffer tube, the portion of the tube or sheath is no longer available to provide protection to the remaining fibers.

[0006] US-A-3 902 206 discloses pliers for removing insulation from cables. US-A-4 331 379, US-A-4 746 190, US-A-5 155 789, US-A-5 181 268, US-A-5 345 526 and US-A-5 408 564 disclose various types of optical fiber cables. US-A-5 085 114 teaches a method for facilitating removal of insulation from metal wires.

SUMMARY OF THE INVENTION

[0007] It is an object of the present invention to provide a method for accessing an optical fiber contained in an optical fiber buffer tube or sheath. It is another object of the present invention to provide a method for accessing an optical fiber which leaves the buffer tube or sheath accessed substantially in-tact after access has been made.

[0008] The present invention is designed to meet the foregoing objectives by providing a method for accessing a fiber from a bundle of fibers disposed in a sheath. The method is characterized by the characterizing portion of claim 1 and comprises several steps, including: cutting the sheath circumferentially at a leading position and cutting the sheath circumferentially at a trailing position to divide the sheath into a leading section, a mid-section and a trailing section; spreading the cut sheath along the axis of the sheath between the leading section and the mid-section to create a first access opening; cutting a fiber to be accessed at the first access opening so as to create an accessible fiber portion and a severed fiber portion; pushing the leading section and mid-section together to close the first access opening; spreading the cut sheath along the axis of the sheath between the mid-section and the trailing section to create a second access opening; pulling the accessible fiber portion from the mid-section of the sheath so that the accessible fiber portion extends out of the second access opening; and pushing the mid-section and trailing section of the sheath together to close the second access opening wherein the accessible fiber portion is permitted to extend out of the trailing cut.

[0009] The invention will be more fully understood when reference is made to the following detailed description taken in conjunction with the accompanying draw-

ings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The drawings, not drawn to scale, include:

FIG. 1, which is a cross-sectional view of an optical fiber cable containing six optical fiber groups, each of the group being formed by four optical fibers and sheath enveloping the optical fibers;

FIG. 2, which is a side view of a sheath and optical fibers forming one of optical fiber groups contained in the optical fiber cable illustrated in FIG. 1;

FIG. 3, which is a side view of the optical fiber group illustrated in FIG. 2 having leading and trailing cuts made therein to form a leading section, a mid-section and a trailing section;

FIG. 4, which is a side view of the optical fiber group illustrated in FIG. 3, wherein the leading section and mid-section are separated from each other to enable access to the fibers;

FIG. 5, which is a side view of the optical fiber group illustrated in FIG. 3, wherein the mid-section and trailing section are separated from each other to enable access to the fibers; and

FIG. 6, which is a side view of the optical fiber group illustrated in FIG. 3, wherein the sheath is pushed back together but an accessed optical fiber is allowed to pass through the trailing cut.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

[0011] The present invention concerns a method for accessing optical fibers in an optical fiber buffer tube or sheath of an optical fiber cable for the purpose of dropping one or more optical fibers from the cable. Dropped optical fibers from an optical fiber cable are typically spliced to other optical fibers. These optical fibers may be terminated at a home or office for example. The method will be described hereinafter with respect to an optical fiber cable **10** such as that illustrated in FIG. 1. However, those skilled in the art should appreciate that the method may be practiced on any optical fiber cable containing buffer tubes or sheaths which are loosely contained within a protective jacket.

[0012] In FIG. 1, the optical fiber cable **10** illustrated has a jacket **11** forming a cavity which contains a telecommunications core **12**. The core **12** is formed by a plurality of colored optical fiber buffer tubes or sheaths **14a-14f**, defining optical fiber groups, containing one or more color coded optical fibers, such as fibers **16a-16d** in the first sheath **14a**. A pair of strength members **20a, 20b** are embedded in the jacket **11**. The core **12** may be wrapped with a water swellable and/or heat protection tape as well as aramid, polyester and/or glass yarns **21** if desired.

[0013] Prior to exercising the steps of the present in-

vention, which are described below, access to the cavity of the optical fiber cable **10** is made in an ordinary manner known by those skilled in the art. Access to the jacket cavity is necessary to obtain access to the optical fibers in the buffer tubes or sheaths contained therein forming the core. Referring to FIGS. 2 through 6, once access to the cavity has been accomplished, access to an optical fiber, such as **16d**, contained in one of the sheaths, such as **14a**, can be accomplished by cutting the sheath **14a** circumferentially at a leading position **22** and cutting the sheath **14a** circumferentially at a trailing position **24** to divide the sheath **14a** into a leading section **26**, a mid-section **28** and a trailing section **30** as illustrated in FIG. 2. Once the aforementioned cuts are made, then the sheath **14a** is spread apart along the axis of the sheath between the leading section and the mid-section to create a first access opening **32** as illustrated in FIG. 3. The spreading of the sheath may create some wrinkles **33a** in the sheath. A fiber, such as **16d**, which is to be accessed or dropped is cut at the access opening **32** so as to create an accessible fiber portion **34** and a severed fiber portion **36** as shown in FIG. 4. Once the fiber **16d** is severed, the leading section and mid-section are pushed together to close the first access opening **32** as shown in FIG. 5. Any wrinkles **33a** are smoothed over as necessary. The leading cut may be wrapped with an adhesive tape **37** to keep the leading section **26** and mid-section **28** together. Adhesive tape is preferably used and wrapped completely around the leading cut **22** to provide a seal to prevent ingress of contaminants into the sheath. Afterwards, the sheath is spread apart along the axis of the sheath between the mid-section **28** and the trailing section **30** to create a second access opening **38** as also illustrated in FIG. 5. Again, the spreading of the sheath may result in some wrinkles **33b** in the sheath. The accessible fiber portion **36** of fiber **16d** is pulled from the mid-section **28** towards the trailing section of the sheath **14a** so that the accessible fiber portion **36** extends out of the second access opening **38** as depicted in FIG. 5. Once this is accomplished, the mid-section **28** and the trailing section **30** of the sheath **14a** are pushed together to close the second access opening **38** as shown in FIG. 6. Any wrinkles **33b** are smoothed over as necessary. The accessible fiber portion **36** is permitted to extend out of the trailing cut **24**. Adhesive tape **39** may be wrapped around the trailing cut **24** to keep the mid-section **28** and trailing section **30** together and to prevent the ingress of contaminants, such as moisture, into the sheath **14a** where it could damage the delicate optical fibers **16a-16d** contained therein.

[0014] Under the method, although the sheath **14a** has been accessed to drop an optical fiber, the sheath **14a** remains substantially intact, unlike prior art methods where a portion of the sheath is removed. Because the sheath **14a** remains substantially intact, the other fibers **16a-16c** which are not severed and dropped through the trailing cut **24** remain protected by the sheath **14a**. The method works particularly well with sheaths that are rel-

atively soft and pliable made from materials such as plasticized polyvinyl chloride or polyethylene/polypropylene copolymeric materials. A suitable sheath material for an optical fiber cable which works well with this method is described in pending EP application 00400187.1 (U.S. patent application Serial No. 09/236,873), assigned to the same assignee. The materials described therein are flexible thermoplastic polyolefin elastomers.

[0015] As shown above, the present invention provides a method which enables access to optical fibers contained in a sheath while leaving the sheath substantially intact. The embodiments disclosed herein admirably achieve the objects of the present invention; however, it should be appreciated by those skilled in the art that departures can be made by those skilled in the art without departing from the scope of the invention which is limited only by the following claims.

Claims

1. A method for accessing a fiber from a bundle of fibers (16a-16d) disposed in a sheath (14a-14f), the method comprising the steps of:

- cutting the sheath (14a-14f) circumferentially at a leading position (22) and cutting the sheath circumferentially at a trailing position (24) to divide the sheath into a leading section (26), a mid-section (28) and a trailing section (30);
- creating a first access opening (32) along the axis of the sheath between the leading section and the mid-section;
- cutting a fiber (16a-16d) to be accessed at the access opening (32) so as to create an accessible fiber portion (34) and a severed fiber portion (36);
- pushing the leading section (26) and mid-section (28) together to close the first access opening (32);
- creating a second access opening (38) along the axis of the sheath between the mid-section (28) and the trailing section (30);;
- pulling the accessible fiber portion (34) from the mid-section of the sheath so that the accessible fiber portion extends out of the second access opening;

characterized in that said method further comprises an additional step of

- pushing the mid-section (28) and trailing section (30) of the sheath together to close said second access opening (38) wherein the accessible fiber portion is permitted to extend out of the trailing cut (24),

wherein both said first and second access openings (32, 38) are created by spreading said cut sheaths (14a-14f), said cut sheaths (14a-14f) are made from plasticized polyvinylchloride or

flexible thermoplastic polyolefin elastomers.

2. The method of claim 1 comprising the additional step of physically joining the leading section (26) and the mid-section (28) of the sheath.
3. The method of claim 1 comprising the additional steps of physically joining the leading section (26) and the mid-section (28) of the sheath and sealing the leading cut (22).
4. The method of claim 1, 2 or 3, comprising the additional step of physically joining the mid-section (28) and trailing section (30) of the sheath.
5. The method of claim 1, 2 or 3, comprising the additional steps of physically joining the mid-section (28) and trailing section (30) of the sheath and sealing the trailing cut (24).
6. The method of claim 1 comprising the additional steps of physically joining the leading section (26) and the mid-section (28) of the sheath and physically joining the mid-section (28) and trailing section (30) of the sheath.
7. The method of claim 1 comprising the additional steps of physically joining the leading section (26) and the mid-section (28) of the sheath, sealing the leading cut (22), physically joining the mid-section (28) and trailing section (30) of the sheath, and sealing the trailing cut (24).

Patentansprüche

1. Verfahren zum Zugang zu einer Faser aus einem Bündel von in einer Ummantelung (14a-14d) angeordneten Fasern (16a-16d), das folgende Schritte aufweist:
 - Schneiden der Ummantelung (14a-14f) am Umfang in einer vorderen Position (22) und Schneiden der Ummantelung am Umfang in einer hinteren Position (24), um die Ummantelung in einen vorderen Abschnitt (26), einen mittleren Abschnitt (28) und einen hinteren Abschnitt (30) zu unterteilen;
 - Erzeugen einer ersten Zugangsöffnung (32) entlang der Achse der Ummantelung zwischen dem vorderen Abschnitt und dem mittleren Abschnitt;
 - Schneiden einer Faser (16a-16d), zu der ein Zugang geschaffen werden soll, an der Zugangsöffnung (32), um einen zugänglichen Faserteil (34) und einen herausgelösten Faserteil (36) zu schaffen;
 - Zusammenschieben des vorderen Abschnitts

- (26) und des mittleren Abschnitts (28), um die erste Zugangsöffnung (32) zu schließen;
- Erzeugen einer zweiten Zugangsöffnung (38) entlang der Achse der Ummantelung zwischen dem mittleren Abschnitt (28) und dem hinteren Abschnitt (30);
 - Ziehen des zugänglichen Faserteils (34) aus dem mittleren Abschnitt der Ummantelung, damit der zugängliche Faserteil aus der zweiten Zugangsöffnung ragt, **dadurch gekennzeichnet, dass** das Verfahren außerdem einen zusätzlichen Schritt des
 - Zusammenschiebens des mittleren Abschnitts (28) und des hinteren Abschnitts (30) der Ummantelung aufweist, um die zweite Zugangsöffnung (38) zu schließen, wobei die Möglichkeit geschaffen wird, dass der zugängliche Faserteil aus der hinteren Schnittöffnung (24) ragt, sowohl die erste als auch die zweite Zugangsöffnung (32, 38) durch Auseinanderziehen der geschnittenen Ummantelungen (14a-14f) erzeugt werden und die geschnittenen Ummantelungen (14a-14f) aus plastifiziertem Polyvinylchlorid oder flexiblen thermoplastischen Polyolefinelastomeren hergestellt sind.
2. Verfahren gemäß Anspruch 1, den zusätzlichen Schritt des physikalischen Verbindens des vorderen Abschnitts (26) und des mittleren Abschnitts (28) der Ummantelung aufweisend.
 3. Verfahren gemäß Anspruch 1, die zusätzlichen Schritte des physikalischen Verbindens des vorderen Abschnitts (26) und des mittleren Abschnitts (28) der Ummantelung und des Versiegeln der vorderen Schnittöffnung (22) aufweisend.
 4. Verfahren gemäß Anspruch 1, 2 oder 3, den zusätzlichen Schritt des physikalischen Verbindens des mittleren Abschnitts (28) und des hinteren Abschnitts (30) der Ummantelung aufweisend.
 5. Verfahren gemäß Anspruch 1, 2 oder 3, die zusätzlichen Schritte des physikalischen Verbindens des mittleren Abschnitts (28) und des hinteren Abschnitts (30) der Ummantelung und des Versiegeln der hinteren Schnittöffnung (24) aufweisend.
 6. Verfahren gemäß Anspruch 1, die zusätzlichen Schritte des physikalischen Verbindens des vorderen Abschnitts (26) und des mittleren Abschnitts (28) der Ummantelung und des physikalischen Verbindens des mittleren Abschnitts (28) und des hinteren Abschnitts (30) der Ummantelung aufweisend.
 7. Verfahren gemäß Anspruch 1, die zusätzlichen Schritte des physikalischen Verbindens des vorderen Abschnitts (26) und des mittleren Abschnitts (28)

der Ummantelung, des Versiegeln der vorderen Schnittöffnung (22), des physikalischen Verbindens des mittleren Abschnitts (28) und des hinteren Abschnitts (30) der Ummantelung und des Versiegeln der hinteren Schnittöffnung (24) aufweisend.

Revendications

1. Un procédé d'accès à une fibre d'un faisceau de fibres (16a-16d) disposé dans une gaine (14a-14f), le procédé comprenant les étapes consistant à :

- découper la gaine (14a-14f) circonférentiellement au niveau d'une position avant (22) et découper la gaine circonférentiellement au niveau d'une position arrière (24) pour diviser la gaine en une section avant (26), une section intermédiaire (28) et une section arrière (30) ;
- créer une première ouverture d'accès (32) le long de l'axe de la gaine entre la section avant et la section intermédiaire ;
- découper une fibre (16a-16d) à laquelle on veut accéder au niveau de l'ouverture d'accès (32) de sorte à créer une partie de fibre accessible (34) et une partie de fibre coupée (36) ;
- pousser la section avant (26) et la section intermédiaire (28) conjointement pour fermer la première ouverture d'accès (32) ;
- créer une seconde ouverture d'accès (38) le long de l'axe de la gaine entre la section intermédiaire (28) et la section arrière (30) ;
- tirer la partie de fibre accessible (34) de la section intermédiaire de la gaine de telle sorte que la partie de fibre accessible dépasse de la seconde ouverture d'accès ;

et **caractérisé en ce que** ledit procédé comprend en outre une étape supplémentaire consistant à :

- pousser la section intermédiaire (28) et la section arrière (30) de la gaine conjointement pour fermer ladite seconde ouverture d'accès (38), par laquelle la partie de fibre accessible dépasse hors de la découpe arrière (24),

dans lequel lesdites première et seconde ouvertures d'accès (32, 38) sont créées en écartant lesdites gaines découpées (14a-14f), lesdites gaines découpées (14a-14f) étant réalisées à partir d'élastomères de polychlorure de vinyle plastifié ou de polyoléfine thermoplastique souple.

2. Le procédé selon la revendication 1, comprenant l'étape complémentaire consistant à assembler physiquement la section avant (26) et la section intermédiaire (28) de la gaine.

3. Le procédé selon la revendication 1, comprenant les étapes complémentaires consistant à assembler physiquement la section avant (26) et la section intermédiaire (28) de la gaine et à souder la découpe avant (22). 5
4. Le procédé selon la revendication 1, 2 ou 3, comprenant l'étape complémentaire consistant à assembler physiquement la section intermédiaire (28) et la section arrière (30) de la gaine. 10
5. Le procédé selon la revendication 1, 2 ou 3, comprenant en outre les étapes complémentaires consistant à assembler physiquement la section intermédiaire (28) et la section arrière (30) de la gaine et à souder la découpe arrière (24). 15
6. Le procédé selon la revendication 1, comprenant les étapes complémentaires consistant à assembler physiquement la section avant (26) et la section intermédiaire (28) de la gaine et à assembler physiquement la section intermédiaire (28) et la section arrière (30) de la gaine. 20
7. Le procédé selon la revendication 1, comprenant les étapes complémentaires consistant à assembler physiquement la section avant (26) et la section intermédiaire (28) de la gaine, à souder la découpe avant (22), à assembler physiquement la section intermédiaire (28) et la section arrière (30) de la gaine, et à souder la découpe arrière (24). 25
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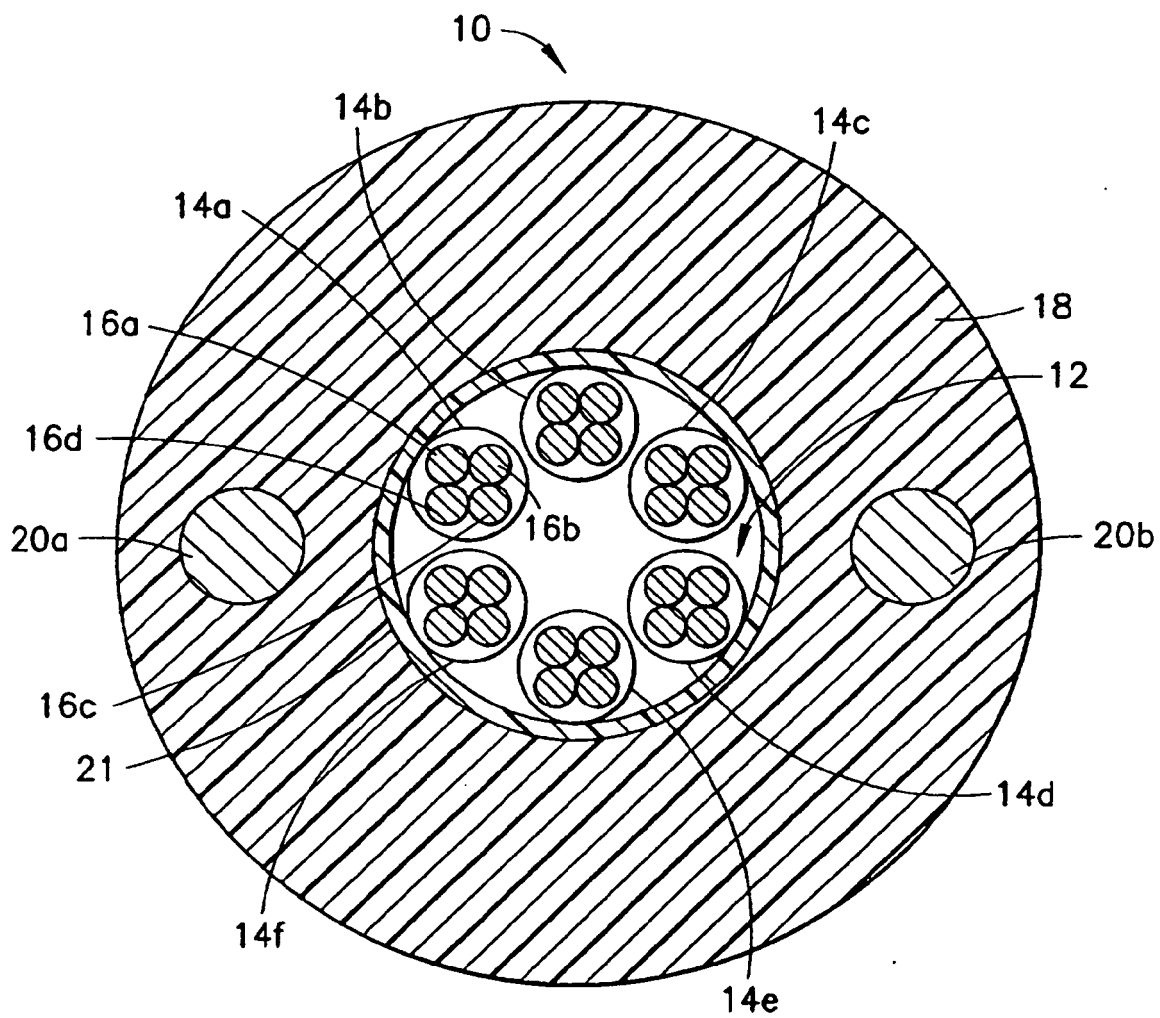


FIG. 1

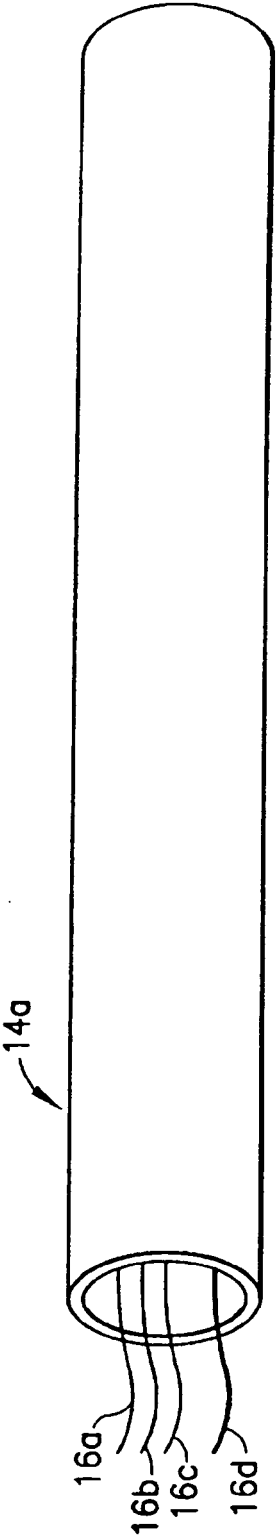


FIG. 2

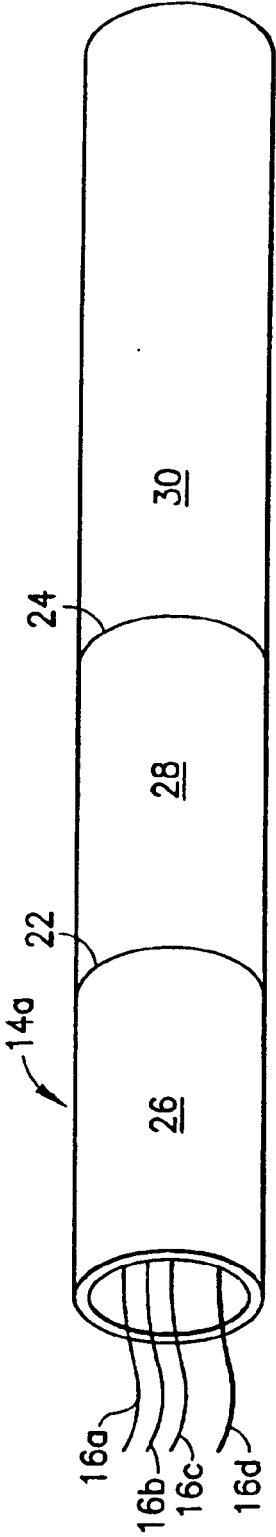


FIG. 3

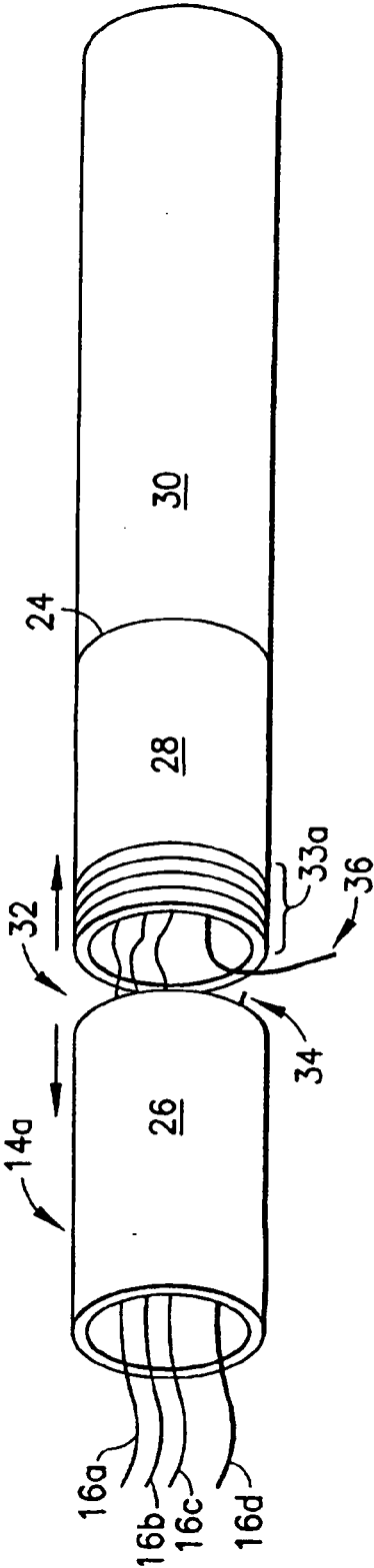


FIG. 4

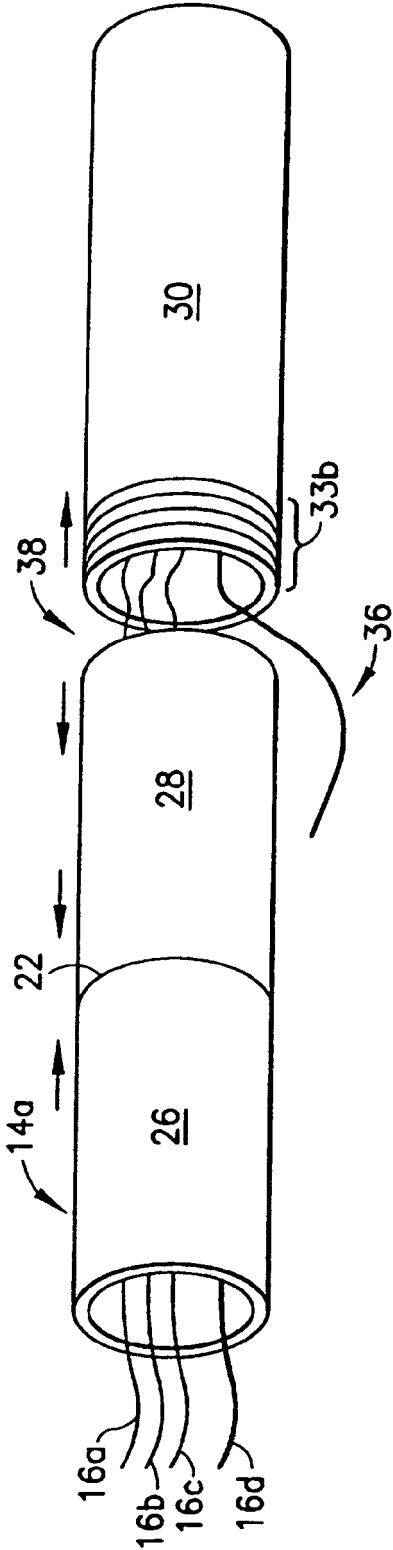


FIG. 5

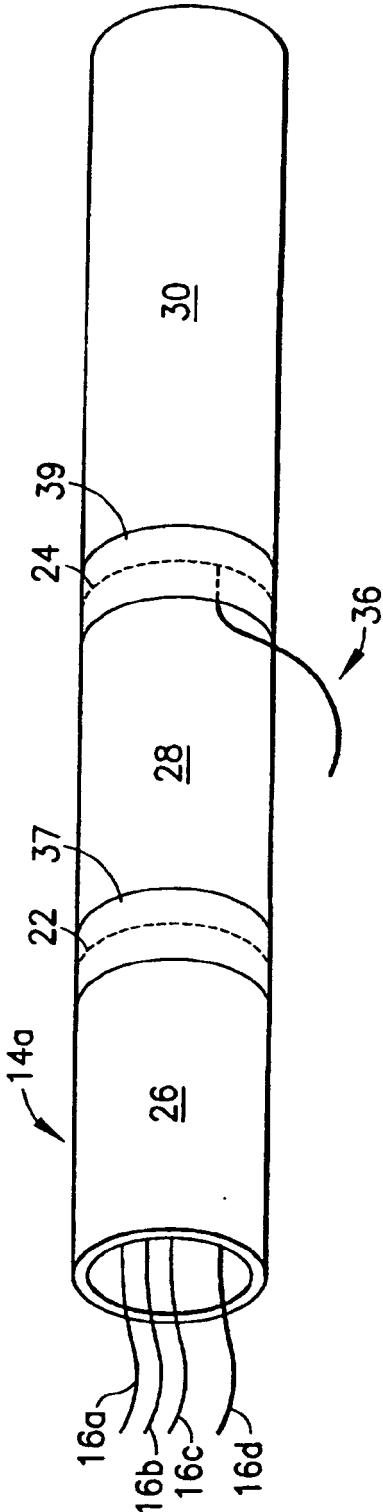


FIG. 6

REFERENCES CITED IN THE DESCRIPTION

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