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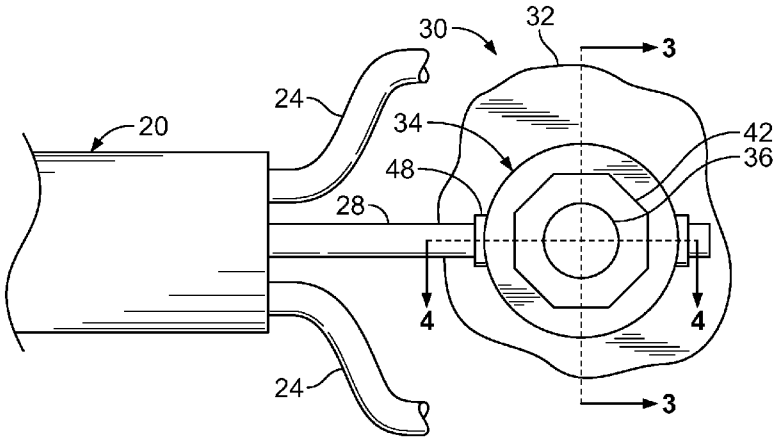

FIG. 2

(57) Abstract: The present disclosure relates to an assembly having a telecommunications cable that includes at least one signal conveying member and a strength member. The assembly also has a clamp mechanism for anchoring the strength member relative to another structure. The assembly further has a protective sleeve positioned over the strength member for providing a protective interface between the clamp mechanism and the strength member.

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APPARATUS AND METHOD FOR CABLE STRENGTH MEMBER PROTECTION

This application is being filed on 14 December 2012, as a PCT International Patent application and claims priority to U.S. Patent Application Serial No. 61/570,676 filed on 14 December 201 1, the disclosure of which is incorporated herein by reference in its entirety.

Technical Field

The present disclosure relates generally to strength members used for reinforcing cables such as telecommunications cables. More particularly, the present invention relates to systems and methods for anchoring strength members of telecommunications cables to provide strain relief.

Background

A typical telecommunications cable includes an outer jacket that surrounds and encloses one or more signal conveying elements (e.g., copper wires, optical fibers). A typical telecommunications cable also typically includes one or more strength members positioned within the jacket for reinforcing the telecommunications cable. Example reinforcing members include flexible members such as aramid yarn that reinforce the telecommunications cable with respect to tensile loads, and reinforcing rods that provide reinforcement to the telecommunications cable in both compression and tension. A typical reinforcing rod configuration includes a plurality of reinforcing elements (e.g., glass fibers) embedded in a matrix material such as an epoxy resin.

The strength members of a telecommunications cable are designed to protect the signal conveying members contained within the telecommunications cable from damage. At a location near where the signal conveying members are terminated, the strength members are anchored or otherwise attached to another structure so as to provide strain relief. For example, the strength members are often anchored to a housing, wall, panel or other structure. In this way, when a tensile load is applied to the telecommunications cable, the load is transferred through the strength members to the structure to which the strength members are anchored such that load is not applied to the signal conveying members of the telecommunications cable.

Fasteners such as bolts, screws, nuts or other clamping devices are often used to anchor strength members to other structures to provide strain relief. In the case of relatively stiff, rod-like strength members (e.g., strength members formed by glass rovings embedded in an epoxy matrix), it has been determined that such clamping action may damage the strength member. Improvements are needed in this area.

Summary

The present disclosure relates generally to methods and systems for anchoring a cable strength member to another structure so as to provide strain relief. In certain embodiments of the present disclosure, the strength member is anchored to the other structure using a clamping action, and an intermediate protective sleeve is positioned between a clamping element and the strength member to protect the strength member. In certain embodiments, the intermediate protective sleeve can be made of a metal material. In certain embodiments, metal material is deformed beyond its plastic limits during the clamping process. In still other embodiments, the protective sleeve is a crimp sleeve. In certain embodiments, the crimp sleeve has a brass construction. In certain embodiments, the crimp sleeve can be pre-crimped on the strength member before the clamping action. In other embodiments, the crimp sleeve is not pre-clamped prior to the clamping action, and the clamping action itself deforms the crimp sleeve against the strength member to affix the crimp sleeve relative to the strength member and to concurrently affix the crimp sleeve relative to the structure to which it is desired to anchor the strength member.

It will be appreciated that the aspects of the present disclosure relate to systems that allow strength members to efficiently and effectively be anchored relative to other structures without damaging the structural integrity of such strength members.

Brief Description of the Drawings

Figure 1 is a transverse cross sectional view of an example telecommunications cable;

Figure 2 is a top, plan view of the telecommunications cable of Figure 1 with a strength member of the telecommunications cable anchored at a fixation site to provide strain relief to the telecommunications cable;

Figure 3 is a cross sectional view taken along section line 3-3 of Figure 2;

Figure 4 is a cross sectional view taken along section line 4-4 of Figure 2;

Figure 5 is a flow chart outlining a method in accordance with the principles of the present disclosure for anchoring a strength member of a telecommunications cable to provide strain relief;

Figure 6 is a cross sectional view illustrating another technique in accordance with the principles of the present disclosure for anchoring a strength member of a telecommunications cable;

Figure 7 is a cross sectional view illustrating a further technique in accordance with the principles of the present disclosure for anchoring a strength member of a telecommunications cable;

Figures 8-10 are photographs showing a protective sleeve in accordance with the principles of the present disclosure for use in protecting and anchoring a strength member of a telecommunications cable to provide strain relief.

Detailed Description

Figure 1 is a transverse, cross sectional view of a telecommunications cable 20. The telecommunications cable 20 includes an outer jacket 22 constructed of a polymeric material. The telecommunications cable 20 also includes a plurality of buffer tubes 24 each containing a plurality of signal conveying members such as optical fibers 26. The telecommunications cable 20 further includes a strength member 28 for reinforcing the telecommunications cable 20 to prevent damage to the optical fibers 26. In a preferred embodiment, the strength member 28 is a relatively stiff rod that provides both tensile and compressive reinforcement to the telecommunications cable. In one embodiment, the strength member 28 includes a relatively stiff rod formed by a plurality of reinforcing fibers (e.g., glass rovings or other glass fibers) bonded together by a matrix material such as epoxy or other curable resin.

Figure 2 is a top, plan view of an example fixation site 30 where the strength member 28 of the telecommunications cable 20 is fixed (e.g., anchored, secured, attached, etc.) to another structure 32 (e.g., a panel, a wall, a housing, etc.)

to provide strain relief to the telecommunications cable 20. Because the strength member 28 is anchored to the other structure 32 at the fixation site 30, tensile loads applied to the telecommunications cable 20 are transferred through the strength member 28 to the structure 32 thereby preventing loading from being applied to the optical fibers 26.

In the depicted embodiment of Figure 2, a portion of the outer jacket 22 of the telecommunications cable 20 has been stripped away so as to expose a length of the strength member 28. The exposed strength member 28 is fixed to the structure 32 at the fixation site 30 using a clamp mechanism 34. As shown at Figure 3, the clamp mechanism 34 includes a shank 36 (i.e., a stud, a bolt, or other member) that is fixedly attached to the structure 32. For example, the shank 36 can be embedded in the structure 32 or otherwise attached to the structure 32. The shank 36 includes external threads 38 that extend around the periphery of the shank 36. The shank 36 also includes a pass-through opening 40 through which the exposed end portion of the strength member 28 is passed. The clamp mechanism 34 further includes a clamping element 42 in the form of a nut having internal threads that mate with the external threads 38 of the shank 36. By passing the strength member 28 through the pass-through opening 40 and then threading the clamp element 42 downwardly onto the shank 36, the strength member 28 is clamped between a bottom side 44 of the clamping element 42 and a surface 46 of the shank 36. In this way, tightening the clamping element 42 provides a clamping action that fixes the strength member 28 relative to the structure 32 such that the strength member 28 is prevented from moving along its axis relative to the structure 32.

Referring still to Figures 2-4, a protective sleeve 48 is positioned over the exposed end portion of the strength member 28 prior to the clamping action. In certain embodiments, the protective sleeve 48 has a metal construction capable of plastically deforming when radially compressed. In certain embodiments, the protective sleeve 48 is a crimp sleeve made of a metal material such as brass or annealed brass coated with tin. Of course, other metal materials could be used as well.

Still referring to Figures 2-4, the protective sleeve 48 is positioned over the strength member 28 at a location where the protective sleeve 48 can provide a protective layer between the strength member 28 and the clamping element 42. In

this way, the protective sleeve 48 protects the strength member 28 from abrasion caused by turning the clamping element 42 against the outer surface of the strength member 28 during clamping. Instead, any such abrasion is taken up by the protective sleeve 48.

In embodiments where the protective sleeve 48 is a crimp sleeve, it is possible to pre-crimp the protective sleeve 48 on the strength member 28 at the location desired to be clamped prior to beginning the crimping action. However, this is optional. In other embodiments where the protective sleeve 48 is a crimp sleeve, the crimp sleeve is slid over the strength member 28 to the desired clamping location, and the clamping action is initiated without having pre-crimped the crimp sleeve. In such embodiments, the clamping action itself deforms the protective sleeve 48 into contact with the strength member 28 such that the strength member 28 is axially locked in place with respect to the protective sleeve 48, and the protective sleeve 48 is concurrently locked in place relative to the structure 32. In this way, both the protective sleeve 48 and the strength member 28 are anchored relative to the structure 32 against movement in a direction along an axis 50 of the strength member 28.

Figure 5 illustrates a method in accordance with the principles of the present disclosure. At step 52 of the method, the outer jacket 22 of the telecommunications cable 20 is stripped away to expose an end portion of the strength member 28. At step 54 of the method, the protective sleeve 48 is slid over the end portion of the strength member 28 and aligned with a segment of the strength member 28 desired to be clamped. At step 56 of the method, the protective sleeve 48 and the segment of the strength member 28 desired to be clamped are positioned at the fixation site 30 and oriented at a desired position relative to the clamp mechanism 34. At step 58 of the method, the clamp mechanism 34 is actuated (e.g., by threading the clamping element 42 on the shank 36) to cause the clamping mechanism 34 to compress the protective sleeve 48 in a lateral/radial direction relative to the axis 50 of the strength member 28 to deform the protective sleeve 48 and to anchor the protective sleeve 48 and the strength member 28 at the fixation site 30. At step 60, the protective sleeve 48 distributes a clamping load across the segment of the strength member 28 such that the strength member 28 and the sleeve are anchored relative to the structure 32. The clamping action limits or

prevents axial movement of the strength member 28 relative to the protective sleeve 48 and also limits/prevents axial movement of the protective sleeve 48 relative to the structure 32. In this way, the protective sleeve 48 cooperates with the clamp mechanism 34 to fix the strength member 28 relative to the structure 32.

Figure 6 illustrates an alternative fixation site 130 in accordance with the principles of the present disclosure. The fixation site 130 includes an offset member 131 attached to a structure 132 to which it is desired to anchor the strength member 28 of the telecommunications cable 20. The offset member 131 defines a pass-through opening 140 for receiving the strength member 28. The offset member 131 also defines an internally threaded opening 141 for receiving a threaded fastener 143 in the form of a bolt. By threading the threaded fastener 143 within the threaded opening of the offset member 131, the strength member 28 can be clamped between a lower end 145 of the threaded fastening member 143 and the structure 132. The sleeve 48 is mounted over the segment of the strength member 28 that is clamped between the threaded fastener 143 and the structure 132. In this way, the strength member 28 is protected from damage during the clamping process.

Figure 7 illustrates another fixation site 230 in accordance with the principles of the present disclosure. The fixation site 230 includes a structure 232 relative to which it is desired to anchor the strength member 28 of the telecommunications cable 20. The structure 232 defines an internally threaded opening 235 that receives a threaded end 237 of a threaded fastener 239. By threading the threaded fastener 239 into the threaded opening, the strength member 28 can be clamped between the structure 232 and a head 241 of the threaded fastener 239. The protective sleeve 48 is positioned over the strength member 28 at the location where the strength member 28 is compressed between the head 241 of the threaded fastener 239 and the structure 232. In this way, the protective sleeve 48 provides a protective interface between the clamping mechanism and the structure 232.

The protective sleeve 48 can be referred to a support ring. In use, the protective sleeve defines a bearing surface against which the clamping element engages (i.e., bears, presses, compresses, etc.) during the clamping process. As the clamp is actuated, the protective sleeve deforms and applies pressure to the strength member 28. By placing the sleeve between the clamping element and the strength

member, and by bearing against the sleeve rather than directly against the strength member 28, the clamping force applied to the strength member 28 is more widely and uniformly distributed thereby assisting in maintaining the structural integrity of the strength member upon clamping.

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CLAIMS

1. An assembly comprising:

a telecommunications cable including at least one signal conveying member and a strength member;

a clamp mechanism for anchoring the strength member relative to another structure; and

a protective sleeve positioned over the strength member for providing a protective interface between the clamp mechanism and the strength member.

2. The assembly of claim 1, wherein the strength member is a relatively stiff rod.

3. The assembly of claim 2, wherein the rod includes a plurality of reinforcing fibers embedded in a matrix material.

4. The assembly of claim 3, wherein the reinforcing fibers include glass rovings, wherein the matrix material includes an epoxy resin.

5. The assembly of claim 1, wherein the protective sleeve is a metal sleeve.

6. The assembly of claim 1, wherein the protective sleeve is a crimp tube.

7. The assembly of claim 1, wherein the clamp mechanism includes a clamp element in the form of a threaded fastener.

8. The assembly of claim 7, wherein the threaded fastener includes a clamp element having internal threads.

9. The assembly of claim 8, wherein the member with internal threads is a nut.

10. The assembly of claim 1, wherein the clamp mechanism includes a threaded fastener having a threaded shaft and a head.

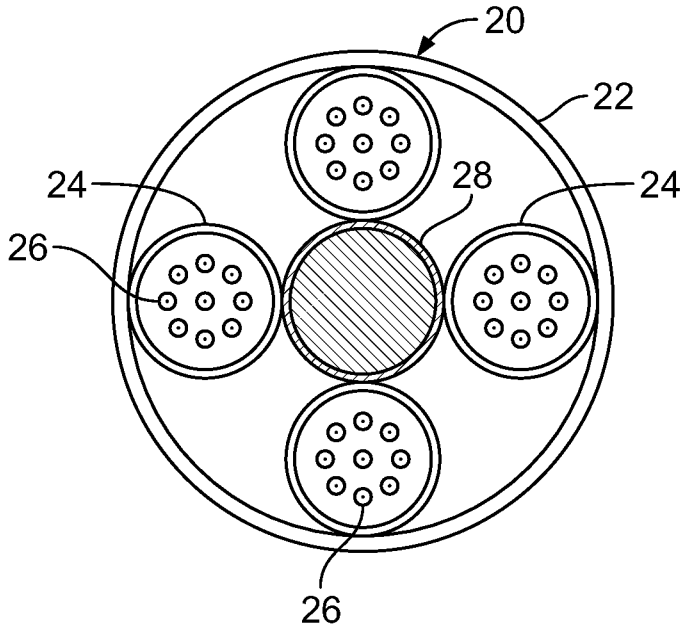

FIG. 1

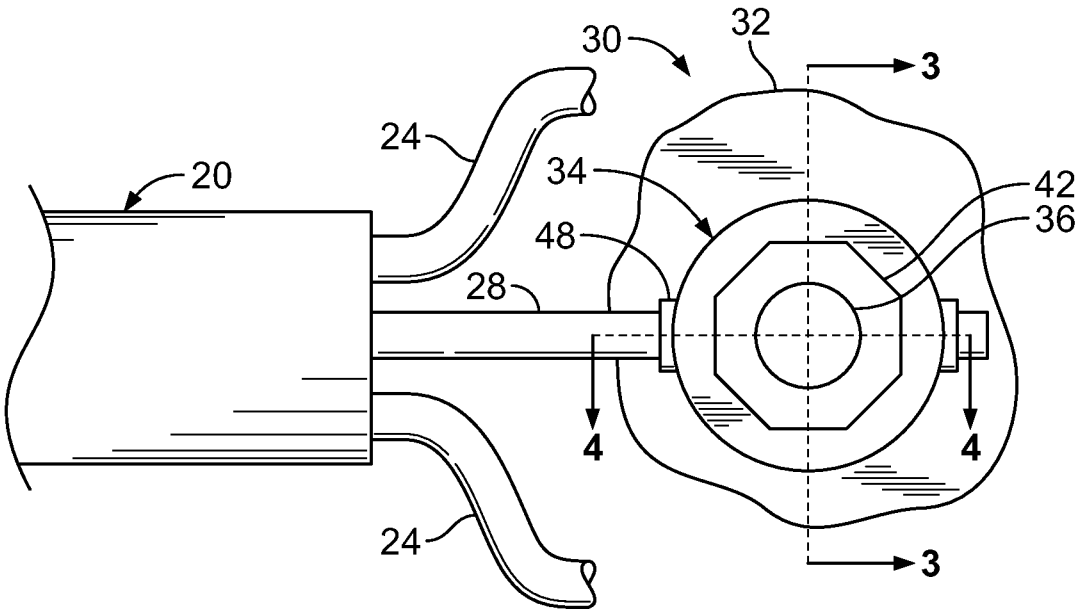

FIG. 2

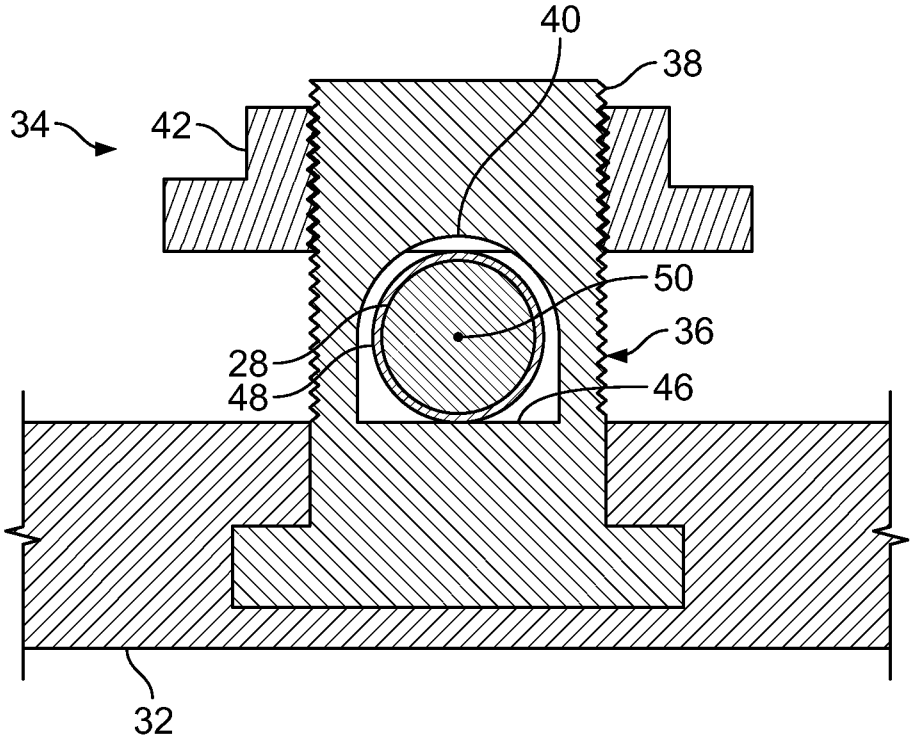

FIG. 3

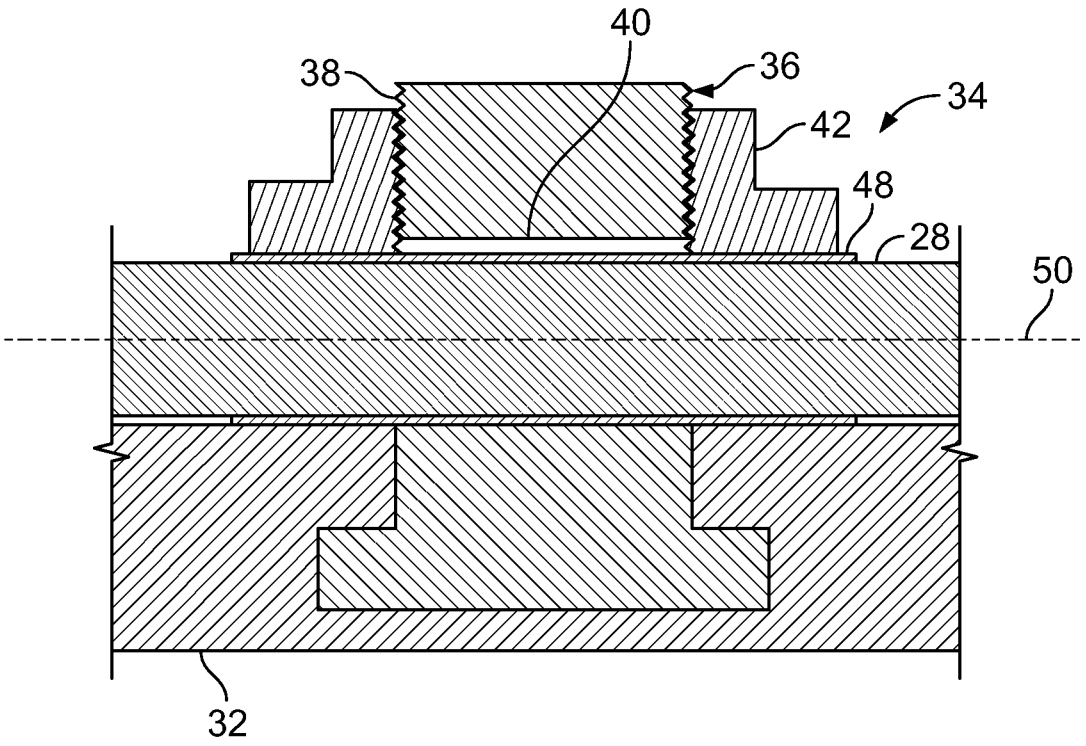

FIG. 4

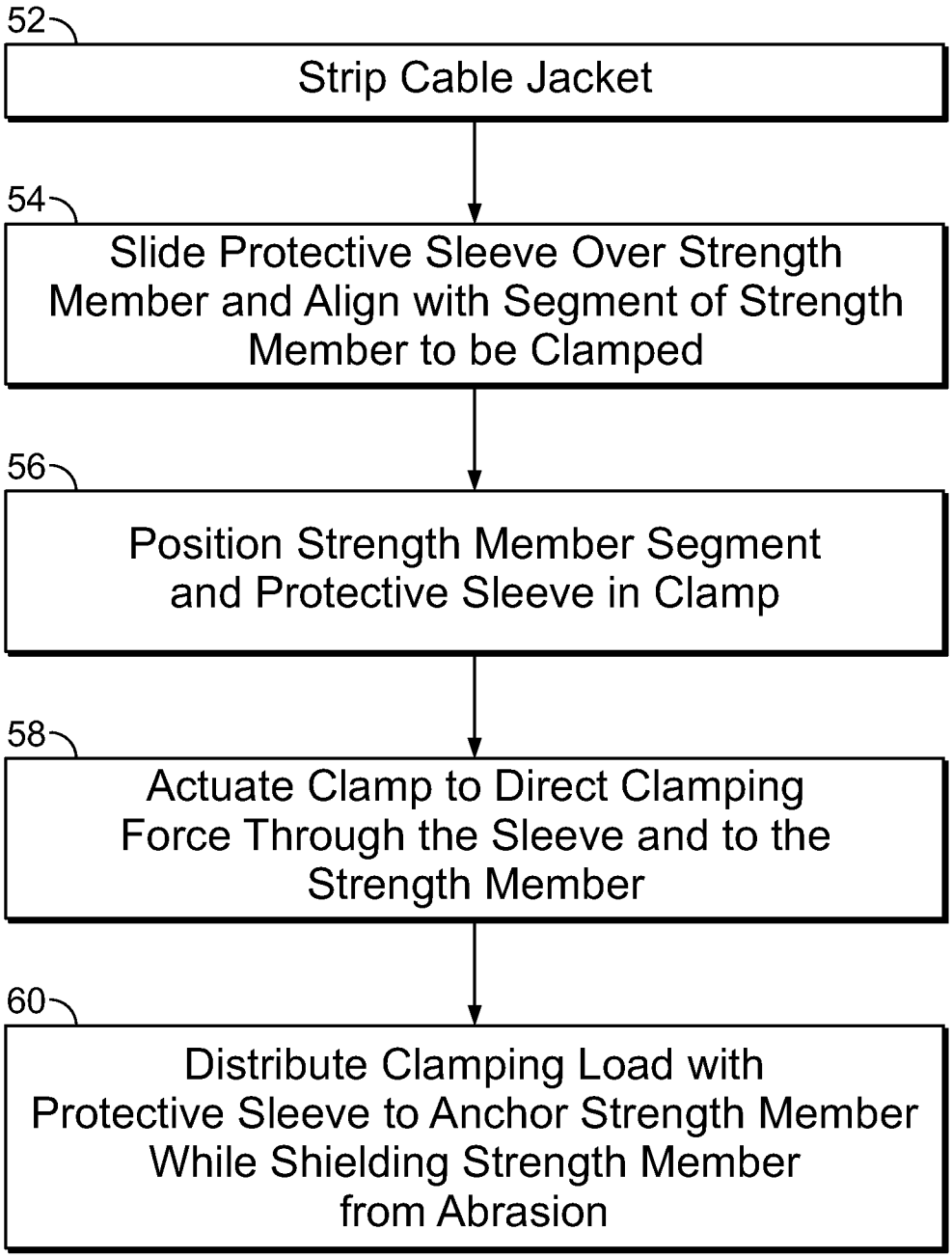
52
Strip Cable Jacket
54
Slide Protective Sleeve Over Strength Member and Align with Segment of Strength Member to be Clamped
56
Position Strength Member Segment and Protective Sleeve in Clamp
58
Actuate Clamp to Direct Clamping Force Through the Sleeve and to the Strength Member
60
Distribute Clamping Load with Protective Sleeve to Anchor Strength Member While Shielding Strength Member from Abrasion

FIG. 5

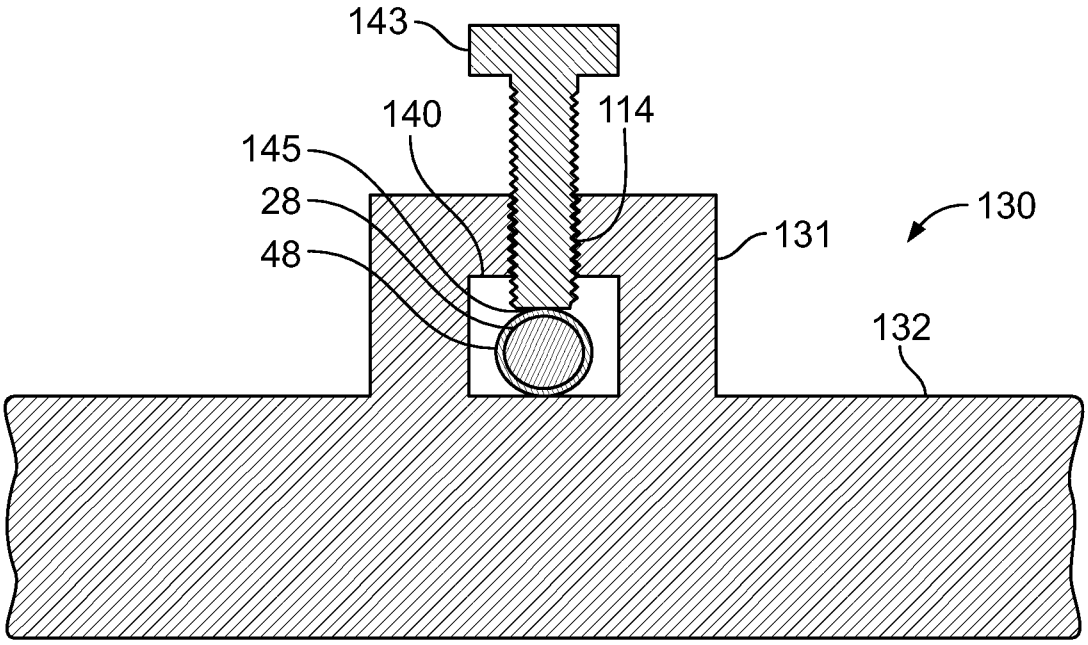

FIG. 6

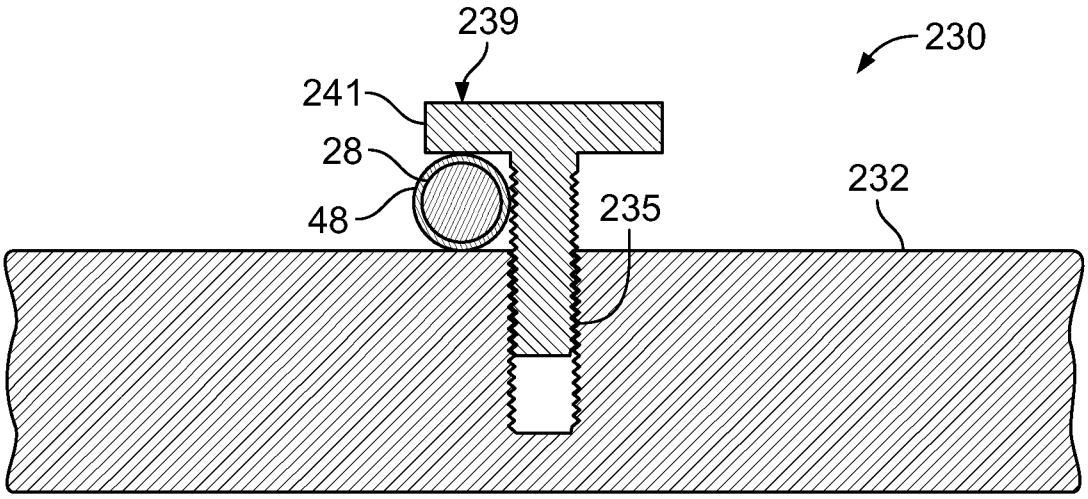

FIG. 7

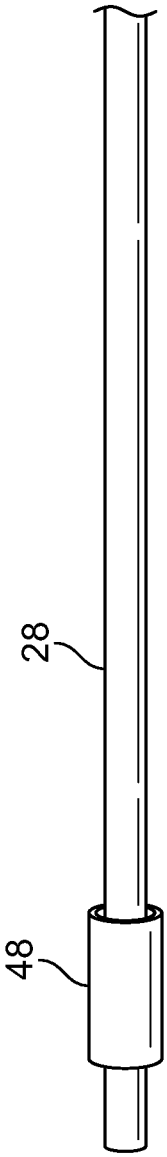

FIG. 8

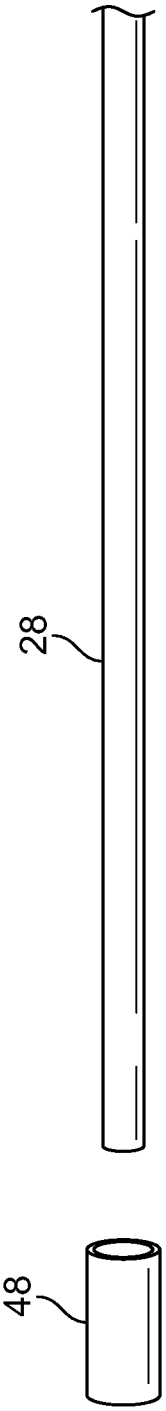

FIG. 9

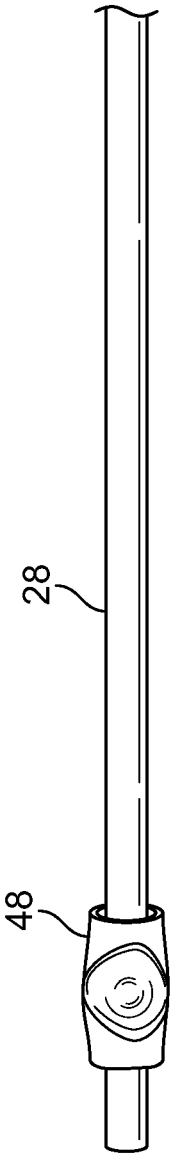

FIG. 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/069772

A. CLASSIFICATION OF SUBJECT MATTER

HOIB ll/22(2006.01)i

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)

HOIB 11/22; A61F 2/00; A61B 17/80; B23Q 3/00; A61F 5/04; G02B 6/00; H01R 13/58

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: cable, strength member, protective sleeve, clamp

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2010-0209067 Al (BECK RONALD A.) 19 August 2010 See abstract, paragraphs [0015]-[0025] ,[0043]-[0046] , claims 1-9 and figures 1-5.	1-10
Y	US 5415658 A (KILPELA THOMAS S. et al.) 16 May 1995 See abstract, column 5, lines 11-31, claim 1 and figures 1-6.	1-10
A	US 2003-0171025 Al (LEBENDER ROLAND) 11 September 2003 See abstract, paragraphs [0027]-[0033] , claims 1-6 and figures 1-2.	1-10
A	US 2002-0049446 Al (HARKEY, III HAYNES LOUIS et al.) 25 April 2002 See abstract, paragraph [0034] and figure 1.	1-10
A	US 2008-0303198 Al (OH MICHAEL H.-S. et al.) 11 December 2008 See abstract, paragraphs [0027]-[0032] and figures 1-3,8.	1-10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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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
19 April 2013 (19.04.2013)	**29 April 2013 (29.04.2013)**

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan City, 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

KIM, Tae Hoon

Telephone No. 82-42-481-8407

Form PCT/ISA/210 (second sheet) **(July** 2009)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/US2012/069772

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