

- [54] **PROTECTIVE WRAPPING FOR ELONGATED MEMBER**
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3,500,867	3/1970	Elson	138/125
3,116,760	1/1964	Matthews.....	138/125
2,441,321	5/1948	Inyalls	138/110
1,249,038	10/1917	Dabney.....	138/110

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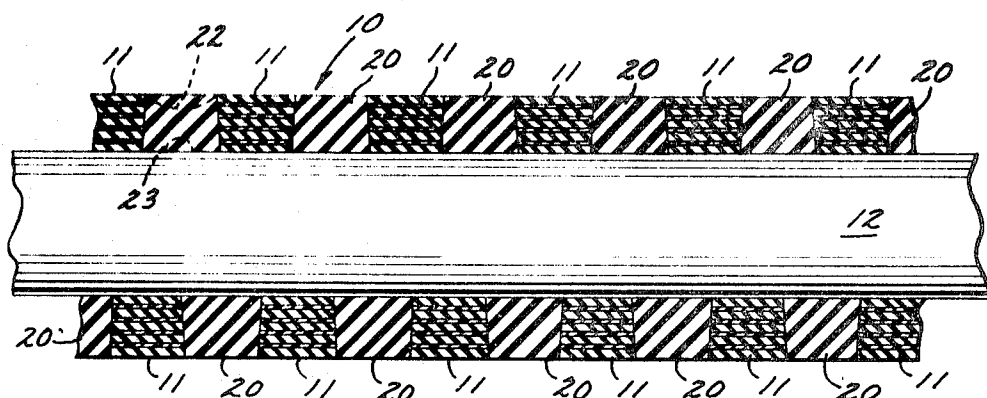
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- [58] Field of Search..... 156/143, 144, 184, 156/212, 215, 187, 190; 161/239, 240, 47, 144; 138/110, 125, 126; 174/136

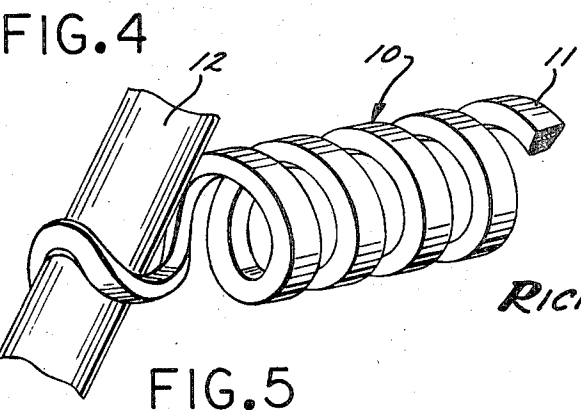
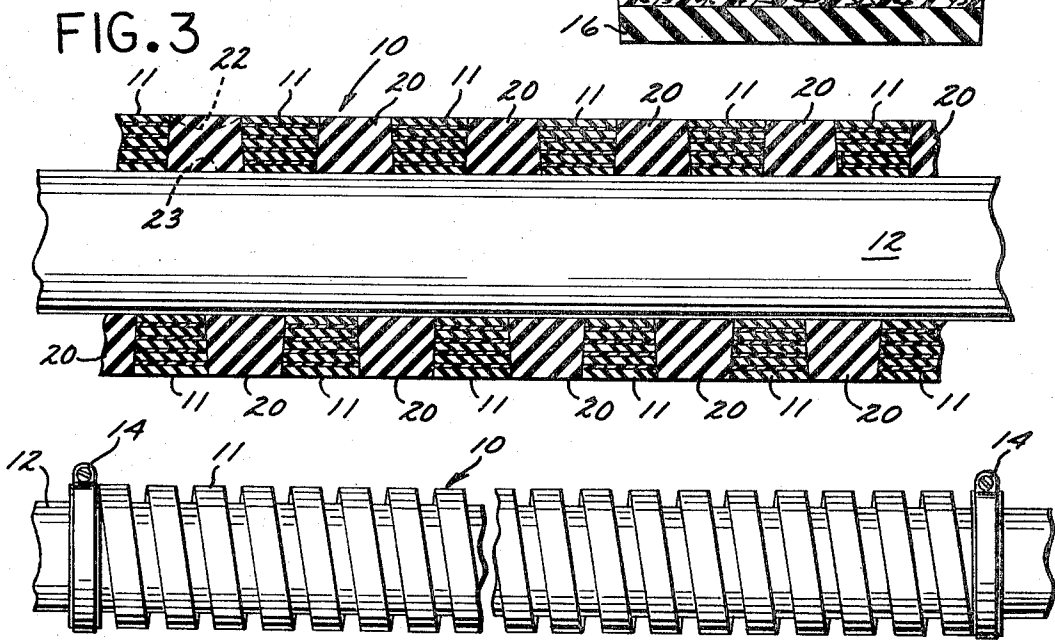
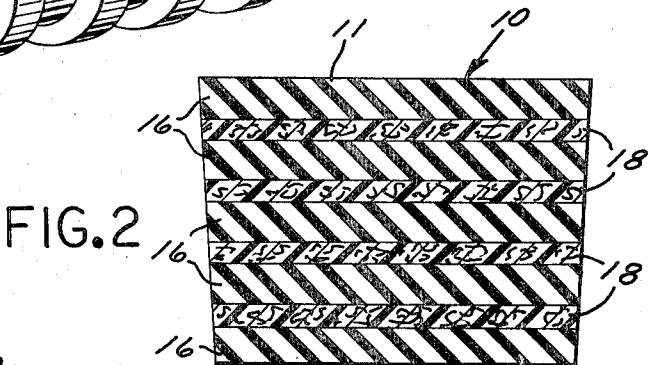
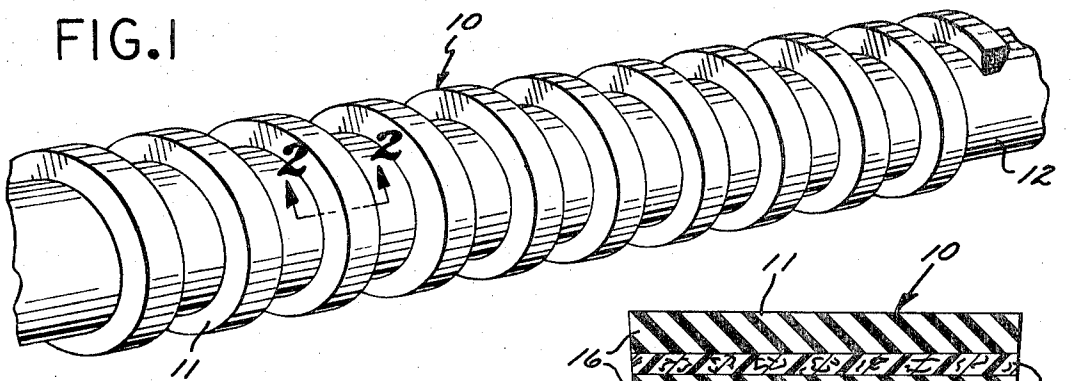
- [56] **References Cited**
UNITED STATES PATENTS
- | | | | |
|-----------|---------|----------------------|---------|
| 2,698,032 | 12/1954 | Bacon | 161/144 |
| 1,776,879 | 9/1930 | Baekeland | 138/126 |
| 1,977,775 | 10/1934 | Patterson | 138/110 |
| 3,616,123 | 10/1971 | Reynolds et al. | 161/47 |

[57] **ABSTRACT**

A protective wrapping for an elongated member of generally circular cross section, and particularly an abrasion resistant wrapping to protect marine cables and conduits. The wrapping is a helically oriented element formed of laminations preventing it from being opened outwardly and away from the protected cable, but allowing the cable to flex. The wrapping can be installed by placement crosswise on the cable and winding it about the cable to set successive turns. Clamps, or a helical filler located between turns of the element, are used to axially extend the wrapping to effect a tight grip upon the protected cable.

5 Claims, 5 Drawing Figures





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PROTECTIVE WRAPPING FOR ELONGATED MEMBER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a protective wrapping for an elongated member, and more particularly to such a wrapping which is abrasion resistant and which allows the protected member to flex or bend.

2. Description of the Prior Art

Heretofore the protection of marine or submerged cable was an expensive and time consuming operation. For example, it is important in many applications to lay cable or conduit on the ocean bottom over rough terrain, ledges, reefs, sharp coral and the like, and in areas where strong currents are apt to cause appreciable movement of the cable. In the past such cable was protected by sections of a cast metal sheathing. Each section was heavy, fitted with special interengaging clamps and brackets, and had to be installed in situ by divers. Installation was tedious and hazardous.

Prior art metal sheathing was relatively shortlived because of the corrosive conditions present at the ocean bottom. Attempts were also made to use a wrapping of asphalt or tar saturated fibrous material, particularly on smaller cables. This improved the resistance to corrosion, but adjacent underwater objects and crossing cables soon abraded away the wrappings, especially where underwater currents were strong. Not only does this result in failure of the cable, which may be a telephone link of extreme importance for example, but if the protected member were a conduit carrying deleterious substances, the failure of the conduit could have a disastrous effect upon the environment.

SUMMARY

According to the present invention, a protective wrapping is provided for an elongated member of generally circular cross section, with the wrapping comprising a helically extending element adapted for disposition about the elongated member in close-fitting relation. The wrapping is made of elastomeric material resistant to abrasion and corrosion, and laminated to strongly resist radially outward movement of the helical turns. However, the wrapping can be installed in situ, such as by a diver working on a submerged cable, by placing the wrapping crosswise of the cable to locate the cable between the end turns of the wrapping, and thereafter winding the body of the wrapping about the cable to place successive turns upon the cable.

In one embodiment the ends of the wrapping are clamped, preferably after the wrapping is axially extended upon the protected member, to maintain a tight grip of the wrapping upon the member. In another embodiment a helical filler is located between the turns of the first helical element to effect the axial extension, and also to provide additional abrasion resistance, while yet still allowing flexing and bending of the protected member.

The wrapping can be made in any length desired, provides extreme environmental and abrasion protection because of the tough elastomeric materials used, allows flexing, and does not require clamping when properly dimensionally configured. It can be installed at the point of manufacture or in the field, and has wide application to the wrapping of any elongated element, such as a tube, conduit, cable or the like, which has to

flex somewhat and has to be cushioned or protected from wear and abuse, whether to prevent destruction of the protected member or to protect the environment from the contents of such a member whose integrity

has been destroyed.

Other objects and features of the invention will become apparent from consideration of the following description taken in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a protective wrapping, according to the present invention, comprising a helical element mounted upon an elongated member to be protected;

FIG. 2 is an enlarged view taken along the line 2—2 of FIG. 1;

FIG. 3 is a longitudinal cross sectional view of another embodiment of the present invention, in which a helically disposed filler is arranged between the turns of the helical element of FIG. 1;

FIG. 4 is a side elevational view of the element of FIG. 1, and including a pair of clamping means at the element extremities to constrain the element against axial movement; and

FIG. 5 is a perspective view of the element of FIG. 1, illustrating the manner of mounting the element upon the elongated member.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With particular reference to FIG. 1 of the drawings, there is illustrated a protective wrapping 10 having an internal diameter such that it is disposed about an elongated member of generally circular cross section in close-fitting relation. For the purpose of this description the elongated member is assumed to be a marine cable 12 which is to be protected against abrasion and damage from underwater objects or the like.

As will be seen, the wrapping 10 must be adapted to tightly grip itself upon the cable 12, resisting axial movement along the cable 12, and particularly resisting any opening movement in a radially outward direction which would have the effect of increasing the diameter of the wrapping and tearing it away from the cable. In addition, the wrapping must be capable of being installed in situ by a diver working under water, and it must permit flexing and bending movements of the protected cable 12. In order to accomplish these purposes, the wrapping 10 comprises a helically oriented element 11 having a plurality of uniformly spaced apart turns.

As will subsequently be described, the wrapping 10 is prevented from deforming radially outwardly by reason of its laminated construction. However, it can be deformed in a direction generally normal to the longitudinal axis of the element 11, as illustrated in FIG. 5. With this arrangement, if the wrapping 10 is disposed generally transversely of the cable 12, the cable 12 can be located between the pair of end turns and one of the end turns can then be deformed sufficiently to locate it around the cable. The remaining turns are next wound about the periphery of the cable 12 in succession to seat them in position. In FIG. 5 half a turn is shown held securely by engagement with the cable, while the other half turn is being deformed axially to lay it over the cable.

After the wrapping 10 is in position upon the cable 12, axial extension of the wrapping 10 has the effect of reducing the internal diameter of the wrapping 10 so that the wrapping closely grips the cable 12, tending to prevent further axial movement. One method of anchoring the wrapping 10 to the cable 12 is illustrated in FIG. 4, a pair of anchorage means or annular clamps 14 being utilized to prevent the wrapping from being moved axially. Each clamp 14 is in the form of a band disposed about an end turn, and having a pair of confronting end flanges which are clamped together by usual fasteners disposed through the flanges, as will be apparent. Preferably one clamp 14 is placed in position to clamp one end of the wrapping 10, the wrapping 10 axially extended, and then the second clamp 14 is located in position.

The laminated structure of the element 11 is illustrated in FIG. 2. More particularly, the wrapping 10 includes a plurality of generally parallel, axially oriented, and helically extending laminations of elastomeric material in the form of rubber layers 16 which are strongly bonded together by any suitable means. The rubber may be any natural or synthetic type, or suitable combinations thereof, and in an uncured state. Between these rubber layers 16 are layers 18 of high tensile strength fabric material, such as 8 ounce woven glass fiber cloth.

In one suitable embodiment the rubber material of the layer 16 is a tough, vehicle tread wear grade of urethane rubber, although other materials are also satisfactory if they possess corresponding high resistance to abrasion and penetration by rocks, coral, and the like, and good chemical and bio-chemical resistance to sea water.

When utilizing uncured urethane rubber, the laminated wrapping 10 is formed by arranging alternating rubber and fabric layers 16 and 18 in a suitable mold of the desired helical form. The assembly is then subjected to heat and pressure, as by bagging in cellophane and insertion in an oven. This cures or vulcanizes the rubber of the layers 16, causing it to become plastic and flow into the interstices of the fabric layers 18. This provides a bond between the layers 16 and 18 which has been found to possess even greater tensile strength than that of the rubber of the layers 16. The resistance of the assembly to delamination is productive of great resistance to radially outward deformation, as previously mentioned.

If the elastomer selected for the layers 16 is a cured natural or synthetic rubber, or mixture thereof, the alternating fabric layers 18 are utilized as before, but high strength adhesives are coated upon the faying surfaces of the layers 16 and 18 to ensure a good bond. Thus, if the rubber selected is a 60 durometer cured neoprene, the surfaces of the layers are treated or prepared according to best current practice to bond to the adhesive used.

In this regard, catalytic cured adhesives, and particularly epoxy resins, are satisfactory. One suitable adhesive system is identified by the trademark EPOXY-LITE-8846 and is a product of the Epoxylite Corporation, South El Monte, California. This particular formulation is based upon a diglycidyl ether bisphenol resin and has a molecular weight of approximately 380. It includes a blend of amine curing agents and a diluent to improve wetting with the glass fibers of the fabric layers 18. The resin system has a relatively extended pot life of in excess of one and one-half hours at a room

temperature of 70°F, and cures in approximately one hour at 200°F. It has excellent all around chemical resistance, good wetting, and good adhesion to the layers 16 and 18.

In the cured rubber embodiment, the layers 16 and 18 are coated on their faying surfaces with the adhesive, layed up in a suitable mold of the proper helical shape, preferably with the outermost and innermost layers being rubber layers 16, and the whole subjected to heat to cure the adhesive.

The tensile strength of the fabric layer 18 is usually in excess of 15,000 pounds per square inch, and the strength of the bond between the layers 16 and 18 is preferably in excess of the tensile strength of the rubber layer 16.

Although considerable dimensional variation is possible, it has been found that handling and installation of the wrapping 10 at the point of use is facilitated when the wrapping is made in sections which are abutted together. The sections are preferably four feet or less in length.

In a typical application the cable 12 may have a diameter of 1 inch, in which case the thickness of each rubber layer 16 will be approximately one-sixteenth of an inch, the thickness of each fabric layer 18 will be approximately one thirty-second of an inch, the glue line thickness between the layers will be approximately 0.005 to 0.020 inch, and the total thickness of the assembly will be approximately one-half inch.

Referring now to FIG. 3, an embodiment of the invention is illustrated which utilizes not only the helically extending element 11, but also a helically extending filler 20 disposed in the space between the turns of the element 11 in generally coextensive relation. The filler 20 is preferably also made of an elastomeric, abrasion resistant material such as rubber and has sufficient flexibility that it does not prevent the desired flexing and bending of the cable 12. A durometer valve rubber of about 50 to 60 has operated satisfactorily. If a less flexible, higher durometer rubber is used, such as above 60, there is preferably formed in the filler 20 at the time of molding a pair of continuous, oppositely disposed helically extending grooves 22 and 23, shown in dotted outline in FIG. 3 in one turn of the filler. The grooves 22 and 23 present a reduced cross section which allows limited flexing and bending of the cable 12, but which is still relatively resistant to radially outward deformation of the filler, such as might cause separation of the filler from the cable 12.

The thickness of the filler 20 is made about the same as that of the element 11 so that the outer surfaces of these components are generally flush. The installed thickness of each of these components in an axial direction is generally the same.

The radial thickness of each turn of the element 11 reduces in an inward direction because both the front and rear walls of the turn slope inwardly. Typically if the axial thickness of the outer surface were three-fourths of an inch, the axial thickness at the inner surface would be approximately one-eighth of an inch less.

The configuration of the filler 20 is complementary to that of the element 11, being characterized by a taper in an opposite direction, so that the axial thickness of the filler is approximately three-fourths of an inch at its inner surface, and approximately one-eighth of an inch less at its outer surface.

The axial thickness of the filler is preferably slightly greater, approximately one-eighth of an inch, in its unstressed state. Thus, after the element 11 is located on the cable 12, the end turn of the filler 20 is inserted between the turns of the element 11 and deformed for wrapping upon the cable 12 in the same manner previously described in connection with the element 11. That is, the end turn of the filler 20 is deformed to a position generally at right angles to the nominal axis of the filler 20, and the remainder of the filler 20 is then rotated about the longitudinal axis of the cable 12. Since the axial thickness of the filler 20 is slightly greater than the axial space between the turns of the element 11, the filler 20 is preferably stretched or elongated while it is being installed. This reduces its cross section sufficiently to fit it into the available space. On release of such tension the filler 20 expands and presses against the element 11, axially extending the element 11 and reducing its inner diameter so that it tightly grips the cable 12.

From the foregoing it will be apparent that the protective wrapping 10 provides a continuous covering or sheath for tubing or cable. It is highly resistant to abrasion and impact, provides moderate thermal insulation, and is installable either at the time of manufacture or on the job site. Clamps need not be used to anchor the wrapping to the cable, particularly if the filler material is used or if the inner diameter of the wrapping is made sufficiently small. However, clamps can be utilized if desired.

The wrapping is easily installed without complex tooling and it has sufficient flexibility to allow normal bending or flexing of the cable. The wrapping is easily molded or otherwise fabricated in a relatively inexpensive manner.

Various modifications and changes may be made with regard to the foregoing detailed description without departing from the spirit of the invention. This is particularly true with respect to the dimensions set forth, since these are merely exemplary and will vary according to the durometer or shore valve of the elastomer, and elongation and the like.

I claim:

1. In combination with an elongated member of generally circular cross section, a protective wrapping comprising:

a helically extending element disposed about said elongated member in close-fitting relation, the helical turns of said element being axially spaced apart, said element including a plurality of generally parallel, axially oriented, and helically extending alternating laminations of elastomeric material and fabric material bonded together whereby said helical turns strongly resist deformation radially outwardly in a direction effective to increase the diameter of

said turns; and

a helically extending elastomeric filler having its helical turns disposed within the spaces between said helical turns of said element in generally coextensive relation, the axial width of each of said turns of said elastomeric filler in its unstretched state being greater than the corresponding axial distance between adjacent said turns of said element whereby said turns of said filler exert an axial bias upon said turns of said element tending to move said turns of said element apart and thereby cause said element to tightly grip said elongated member.

2. A combination according to claim 1 wherein the contacting sides of said turns of said filler and said turns of said element are complementally sloped whereby said turns of said filler tend to wedge apart said turns of said element.

3. A combination according to claim 1 wherein the direction of slope of said sides of said filler and said element defines an axially wider inner portion for each of said turns of said filler, compared to the adjacent turns of said element, whereby said turns of said filler exert a bias upon said turns of said element.

4. In combination with an elongated member of generally circular cross section, a protective wrapping comprising:

a helically extending element disposed about said elongated member in sufficiently close-fitting relation that axial extension of said element increases the axial length of the space between the helical turns and decreases the inner diameter of said element, whereby said element tightly grips said elongated member, said element including a plurality of generally parallel, axially oriented, and helically extending alternating laminations of elastomeric material and fabric material bonded together whereby said helical turns strongly resist deformation radially outwardly in a direction effective to increase the diameter of said turns; and

an elastomeric helically extending filler having its helical turns disposed within the spaces between said helical turns of said element in generally coextensive relation, the unstretched axial thickness of said filler being slightly greater than the corresponding axial length of the space between adjacent turns of said element whereby said filler in said space is stretched and exerts a bias upon said element whereby said element tightly grips said elongated member.

5. A combination according to claim 4 wherein said elastomeric material of said element is a tough, vehicle tread wear grade of rubber and said fabric material is woven glass cloth.

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