

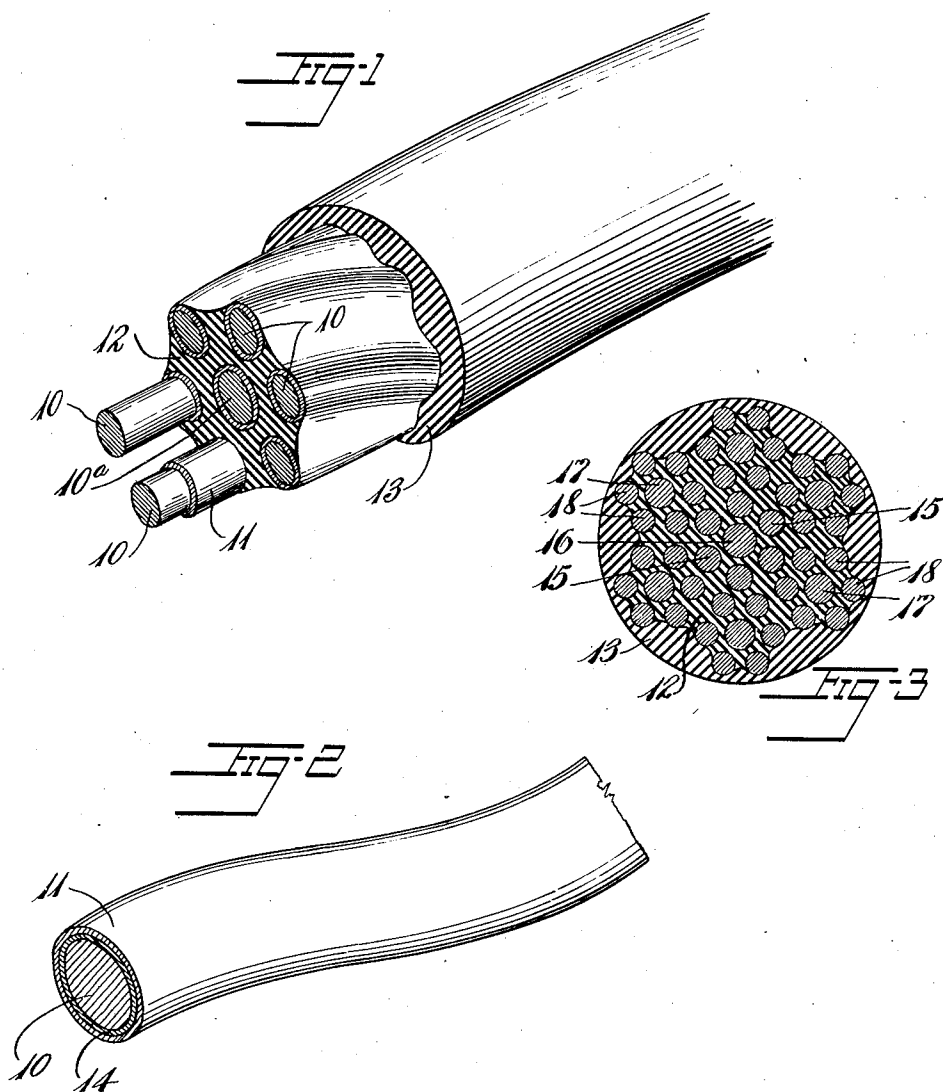
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RUBBER IMPREGNATED METAL CABLE AND METHOD OF MAKING SAME

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RUBBER IMPREGNATED METAL CABLE
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10 Claims. (Cl. 117--2)

This invention relates to rubber impregnated metal cable and to methods of making the same. The article of the invention is especially useful for transmission of power or for hoisting purposes where great resistance to internal chafing or abrasion due to flexing of the cable is required.

This application is in part a continuation of my application Serial No. 651,276 filed January 12, 1933.

Heretofore it has been common to employ stranded wire cables for hoisting and power transmission purposes and for other uses where the cable is subjected to intermittent bending at high velocities. As flexing of the cable and stretching of the elements thereof results in movement of the individual wires with relation to each other, it has been necessary in the past to apply oil or grease to the cables to prevent abrasion or chafing of the wires upon each other. Such lubricants have also served to protect the wires from corrosion.

The presence of grease and oil on the cables not only reduces their tractive power, but also makes them disagreeable to handle and they cannot be used where their contact with material in process of manufacture would soil the material.

While it has been proposed to apply rubber coatings to the strands of ropes or cords made of vegetable or metallic fibers, especially where the ropes or cords were to be incorporated in rubber and fabric structures, such as tires, the introduction of rubber between the wires of a metallic cable, after the cable has been formed, and vulcanization of the rubber to the wires has been accomplished, has heretofore been difficult of achievement, because of the methods by which such cables are manufactured.

As the wires are comparatively stiff, any attempt to apply an unvulcanized coating of rubber composition to the individual wires before they are assembled results either in scraping of the rubber from the wires during their passage through the cabling machine, or in the plastic rubber being forced from between the wires by the stresses in the wires which hold them in twisted relation.

Where it is attempted to coat the wires separately and to vulcanize the coatings before the wires are assembled in cable form, while it may be possible to handle the wires through the cabling machine, the resulting structure permits motion between the coatings in use which soon destroys the coating.

The principal objects of the invention are to

provide resilient cushioning of the wires, to eliminate internal abrasion, to eliminate lubrication, and to provide protection against corrosion.

A more specific object is to provide a cable in which the wires are spaced from each other and the space therebetween is filled with a resilient rubber composition which is bonded to the wires so as to permit movement of the wires in the cable without abrasion of each other.

Other objects will appear from the following description and the accompanying drawing.

Of the drawing:

Fig. 1 is a perspective view of a dissected portion of a simple form of cable.

Fig. 2 is a perspective view of a portion of one of the wires thereof showing the metallic coatings thereon.

Fig. 3 is a cross-sectional view of a compound cable, showing the invention in its preferred form.

Referring to the drawing, and especially to Fig. 1, the numeral 10 designates one of a group of helically disposed wires which are positioned about a core wire 10a in spaced relation to form a simple cable. The wires 10 are preferably of smaller diameter than the core wire 10a so as to insure their being spaced apart circumferentially. Each wire is enclosed in a coating 11 of a rubber adherent metal. The interstices between the wires are entirely occupied by a resilient vulcanized rubber composition filling 12 and an additional cover 13 of similar rubber material surrounds the other elements, the rubber composition being bonded by vulcanization to the metallic coating 11 surrounding the wires.

The metallic coating 11 preferably comprises a mixture of copper and zinc deposited electrically. In order to prevent hydrogenation of the wire during the depositing of the coating 11, it is advisable to employ, in the making of the cable, wire which previously has been coated with tin or other metal not subject to hydrogenation. When the coating of tin or other metal is used this is designated by the numeral 14.

In order to provide space between the wires 10 and the core wire 10a throughout the greater portion of their extent the wires are preformed to the course of their disposition in the finished cable before the cable is assembled, as this minimizes the absence of voids between the wires due to static stresses in the wires resulting from the cabling thereof. For the same reason the wires 10 are merely laid without substantial tension so that they are separated circumferentially from each other. This provides space for the rubber

when the rubber is forced into the interstices of the cable. It will be understood that the equal spacing of the wires is an ideal condition and that in practice the core wire 10a will contact at some places with the wire 10.

In the manufacture of a simple cable according to the invention, after the wires have been preformed to lie without strain along the desired helix, they are loosely cabled together.

Referring to Fig. 3, this illustrates a compound cable having greater flexibility than the simple cable of Fig. 1. In this form of the invention a number of helically preformed wires 15, preferably six are assembled around a straight central wire 16, of slightly larger diameter, to form a simple cable or strand. A plurality of similar strands, preferably six, are similarly formed of a straight central wire 17, somewhat smaller than wire 16, and a plurality, preferably six, of helically preformed wires 18, slightly smaller than wire 17, to provide strands slightly smaller than the central strand. The outer strands are then helically preformed and laid about the central strand.

In the compound form of the invention the individual wires are preferably tinned before assembly to avoid hydrogenation. This coating and the overlying coating of rubber adherent metal have been omitted in Fig. 3 to avoid complicating the drawing.

The formed cable, whether of simple or compound construction, is cleaned to remove all grease, dirt and rust. This may be accomplished by use of detergent and pickling solutions in any well known manner. I prefer, however, first to dissolve all solid grease by washing the cable in solvent naphtha, gasoline, or other organic solvent, then, by brushing the cable to remove all foreign matter.

Thereafter the cable may be further cleaned by successive applications of alkaline caustic material and pickling acid, such as sulfuric acid. These operations may be performed continuously by passing the cable progressively through the solutions and finally washing and reeling the cable.

In order to secure adhesion of the wires to the rubber thereafter to be applied, the coating of rubber adherent metal 11 may now be applied by electroplating the assembled cable. In order to remove moisture remaining in the cable after the electro-plating operation, the cable is first thoroughly dried. This may be accomplished by passing it through a dehydrating agent such as alcohol and then drying it in heated air.

In order thoroughly to fill the interstices between the wires, a coil of the cable is placed in a closed vessel adapted to be evacuated of air. Air is removed from the vessel by a pump. A thick rubber cement is then introduced into the vessel around the cable. After the coil of the cable is covered by the cement, the cement is subjected to super-atmospheric pressures until the interstices are completely filled with rubber. The cable is then removed and permitted to dry. As the cable is loosely laid and the wires are substantially free from static stresses, the wires normally lie apart throughout the greater part of their extent and a cushion filling 12 of rubber is deposited between them. The rubber cement may be of any desired composition but is preferably of the viscosity of a solution having four pounds of vulcanizable masticated rubber to one gallon of benzine.

After the interstices of the cable have been

filled, the cable is removed from the cement and permitted to dry. A coating 13 of vulcanizable rubber composition is then applied to the cable, preferably by passing the cable through the insulating head of an extrusion machine. The rubber is then vulcanized to the metal by application of heat and pressure. A convenient manner of confining the cable during vulcanization is by means of a lead sheath which may be applied around the cable by the extrusion process. Where this is done the ends of the lead sheath may be sealed and the sheathed cable immersed in a bath of hot water or other liquid under such pressure as closely to compact the sheath around the cable by hydrostatic pressure, the plasticity of the lead being of assistance in permitting such compacting of the sheath.

The resulting article has its wires substantially separated and cushioned by the rubber filler which permits movement of wires with relation to each other without abrasion of the wires and without the necessity of lubrication.

While two forms of wire cable only have been shown it is to be understood that cables having a different number of wires and with the wires differently arranged are within the scope of the invention.

I claim:

1. The method of making a flexible tension element which comprises forming a metal cable, thereafter depositing a coating of rubber-adherent metal thereon, filling the interstices between the wires of the cable with a rubber composition, and vulcanizing the resulting structure.

2. The method of making a flexible tension element which comprises forming a metal cable with a coating of rubber-adherent metal on the wires thereof, evacuating the interstices of the cable, filling the interstices with a rubber composition, and vulcanizing the resulting structure.

3. The method of making a flexible tension element which comprises completely filling the interstices between the wires of a metal cable with a rubber composition, applying a cover of rubber composition to the cable, temporarily enclosing the cable in a lead sheath, and vulcanizing the rubber.

4. The method of making a flexible tension element which comprises completely filling the interstices between the wires of a metal cable with a rubber composition, applying a cover of rubber composition to the cable, temporarily enclosing the cable in a lead sheath, and vulcanizing the rubber while compacting the sheath by fluid pressure.

5. The method of making a flexible tension element which comprises loosely cabling a plurality of preformed wires to form a cable, thereafter coating the wires with rubber adherent material, filling the interstices between the wires with a soft rubber composition, and vulcanizing the rubber.

6. The method of making a flexible tension element which comprises loosely cabling a plurality of preformed wires to form a cable, thereafter coating the wires with rubber adherent metal, filling the interstices between the wires with a soft rubber composition, and vulcanizing the rubber.

7. The method of making a flexible tension element which comprises loosely cabling a plurality of preformed wires to form a cable, thereafter coating the wires with rubber adherent material, filling the interstices between the wires with a soft rubber composition, applying a coat-

ing of rubber composition about the cable, and vulcanizing the rubber.

8. The method of making a flexible tension element which comprises loosely cabling a plurality of preformed wires to form a cable, thereafter coating the wires with rubber adherent metal, filling the interstices between the wires with a soft rubber composition, applying a coating of rubber composition about the cable, and vulcanizing the rubber.

9. The method of making a flexible tension element which comprises forming a cable of wires each coated with a metal resistant to hydrogen-

tion, coating the wires of the formed cable with a rubber adherent metal, filling the interstices between the wires with a vulcanizable rubber composition, and vulcanizing the rubber.

10. The method of making a flexible tension element which comprises forming a cable of wires each coated with tin, coating the wires of the formed cable with a rubber adherent metal, filling the interstices between the wires with a vulcanizable rubber composition, and vulcanizing the rubber.

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