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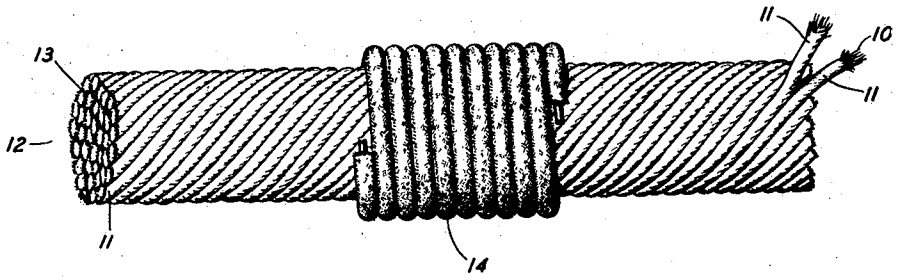
SUBMARINE CABLE LOADING COIL

Filed July 21, 1930



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UNITED STATES PATENT OFFICE

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SUBMARINE CABLE LOADING COIL

Application filed July 21, 1930. Serial No. 469,370.

This invention relates to submarine cables and particularly to loading coils used for loading such cables.

The materials most suitable for the magnetic circuits of submarine cable loading coils are sensitive to mechanical strain and their properties are injuriously affected by such strains. It is an object of this invention to provide a submarine cable loading coil core which will not be detrimentally affected by strains and stresses and other adverse conditions encountered during the laying and/or operation of the cable.

Among the magnetic materials which have been found to be particularly suitable for cores of submarine telephone cable loading coils is a group composed principally of iron, nickel, and cobalt. A preferred composition contains about 47% nickel, 20% iron, 25% cobalt and 8% molybdenum, heat treated in accordance with known methods. Another group of compositions, particularly adapted for use in telegraph cables, is composed principally of nickel and iron, with or without one or more added elements, such as chromium, for increasing the resistivity, or for other purposes, also heat treated as known in the art.

Both groups of magnetic materials suffer from the disadvantage that when subjected to comparatively slight strains their magnetic permeability is considerably reduced and other desirable properties are similarly affected. It is in connection with the use of magnetic materials of these classes or others having similar strain-sensitive properties that coil cores in accordance with the present invention are advantageous.

In accordance with this invention the material used in the loading coil, preferably in the form of fine wires or tapes, is given a helical lay or twist in the manner of the lay used in the manufacture of ordinary jute ropes.

The accompanying drawing illustrates one embodiment of the present invention. The magnetic material has the form of wires 10 arranged in strands 11 having a lay or twist as shown and forming when assembled, a core 12. After the wires and strands are twisted to have a form substantially as the one shown, the core is given a heat or annealing treatment in order to relieve any strain which may have been introduced into the material by the twisting. A simple heating at about 800° C. to 1100° C. for about one hour will sufficiently anneal the magnetic material to relieve strains. If desired, any of the heat treatments described in detail in U. S. Patents 1,586,883, 1,586,884, both granted June 1, 1926 or 1,715,647, June 6, 1929 depending upon whether an iron-nickel composition or an iron-nickel-cobalt composition is used, may be employed. Other magnetic compositions and other suitable heat treatments may be employed. The core wires 10 may be individually oxidized upon their surface before assembly, in accordance with the practice described in U. S. application Serial No. 477,243, filed Aug. 23, 1930, by J. J. Gilbert. The core is preferably impregnated with and surrounded by a thin layer of pressure equalizing material, such as asphalt flux, or such as melted rubber, shown in the core interstices, at 13. The insulated coil winding 14 may be applied to the core either before or after impregnation. If applied before impregnation special care is required to cause the impregnating material to penetrate into the inner interstices of the core. Vacuum impregnation may be employed.

When a submarine cable loading coil comprising a core of the type described is subjected to bending and/or stretching forces, little or no strains are imparted to the individual wires of magnetic material forming the body of the core. This result is achieved by virtue of the fact that upon bending or tensioning, the wires have several degrees of freedom, especially when not tightly wound, permitting them to move to displace the viscous or elastic impregnating material with which they are surrounded. Helical wires can thus adapt themselves to changes in position caused by external stretching or bending forces without being put under strain to the same extent as straight wires.

Although one particular embodiment of this invention has been described herein in detail, the scope of the invention is not limited to the particular embodiment disclosed.

The core wires may be given arrangements and angles of lay different from the embodiment shown. For instance, a smaller lay than the one illustrated in the drawing could be used and stranding of the wires 10 into the strands 11 may be dispensed with and all the wires arranged helically without previous stranding. The word "wires" includes tapes or elongated members of any suitable cross section.

What is claimed is:

1. In a coil loaded deep sea cable, a loading coil core comprising a number of fine wires of strain-sensitive magnetic material, characterized in this that the wires are helically laid, whereby the effects of stresses upon the desired properties of said material during and after the laying of said cable are reduced.

2. A submarine cable loading coil core comprising wires of strain-sensitive material of small diameter laid side by side extending laterally in the direction of the cable axis, at least a portion of the wires having a helical lay, characterized in this that the interstices between the wires are filled with pressure equalizing material.

3. A core as defined in claim 1, further characterized in that the wires are heat treated after being spirally arranged.

4. A core as defined in claim 1 characterized in that the magnetic wires are first arranged in their final form, then heat treated to relieve strains, and then impregnated with pressure equalizing material so that as far as possible they are free to move therein.

5. A core as defined in claim 1 characterized in that the wires are stranded together and the strands arranged into a loose helix.

In witness whereof, I hereunto subscribe my name, this ninth day of July, 1930.

WILLIAM S. GORTON.