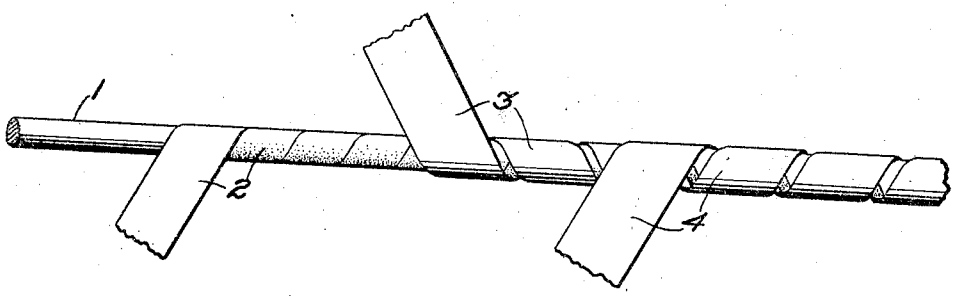
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METHOD OF APPLYING MAGNETIC MATERIAL TO ELECTRICAL CONDUCTORS

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UNITED STATES PATENT OFFICE.

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METHOD OF APPLYING MAGNETIC MATERIAL TO ELECTRICAL CONDUCTORS.

Application filed December 8, 1920, Serial No. 429,224. Renewed April 10, 1926.

This invention relates to the application of magnetic wrappings to electrical conductors, and particularly to the manufacture of continuously loaded signaling conductors.

An object of the invention is to provide a method by which signaling conductors may be continuously loaded and a predetermined permeability at low magnetizing forces in the magnetic material be realized.

In carrying out the above noted object there is preferably applied to the signaling conductor or conductors a magnetic sheath in the form of a layer or layers of tape wound spirally thereon. A suitable magnetic material is the nickel iron alloy described in the U. S. application of G. W. Elmen, Serial No. 473,877, filed May 31, 1921, which is a continuation of application, Serial No. 111,080, filed July 24, 1916. This material has the requisite of high permeability only when properly heat treated, and not subsequently subjected to excessive strain. It was found that the strains set up in this loading material by applying it to the conductor were sufficient to lower the permeability and that this difficulty could be overcome by applying proper heat treatment to the loaded conductor. See the Elmen application referred to above and also application, Serial No. 557,928, filed May 2, 1922, of the same inventor.

Difficulty has been experienced however in obtaining the desired high value of permeability in the loading material at low magnetizing forces when the above described process is used. According to the present invention this difficulty is overcome by covering the signaling conductor with a layer of spacing material before the loading material is applied, the spacing material being of paper, linen, cotton, or woolen fabric, gums or other material of a nature to be removed before or during the heat treatment.

In carrying out the process, the conductor is first covered with the spacing material which is preferably paper tape laid on the conductor spirally. The magnetic material in the form of tape is then laid spirally over the spacing material.

The arrangement of the spacing and magnetic materials may be more readily understood by reference to the drawing. The conductor 1 is covered throughout its length by the paper tape 2 and magnetic wrappings 3 and 4 oppositely wound are placed over the paper tape. The outer layer of magnetic tape may sometimes be omitted. The magnetic tapes are then subjected to a heat treatment, preferably by passing the wrapped conductor through a suitable furnace at a suitable rate and cooling the conductor at a proper rate after it emerges from the furnace. During the treatment the paper tape is completely burned away and a small space left between the magnetic tape and the conductor.

A possible explanation of the effectiveness of the above process in producing a desired permeability at low magnetizing forces in the magnetic material, is that the presence of the paper affords the necessary space for the conductor during the expansion and contraction of the conductor and loading material produced by the annealing treatment. When the magnetic material is wound directly upon the conductor, strains and stresses appear to be set up in the magnetic wrapping resulting in a lowering of the permeability; hence, the provision of the layer between the conductor and magnetic wrapping, which may subsequently be readily removed, will prevent the strain and stress on the magnetic material. The outer layer of magnetic wrapping which is shown in the drawings need not be separated from the first wrapping by a layer of protective material on account of the fact that the thickness of the magnetic material is so small that the two layers may behave as though they were a single layer of twice the thickness.

It is probable also that the difficulty overcome by this invention may be due in part or entirely to the fact that the magnetic material contracts more quickly than the central conductor during the cooling which follows the heat treatment because of the intimate contact of the magnetic material with the cooling medium.

Although the invention has been particularly described with reference to loading signaling conductors, it is to be understood that it is equally applicable to other uses. The spacing layer may be removed before or during the heat treating operation, the necessary feature being that it must be present during the wrapping of the mag-

netic material, but absent when the space occupied by it is essential to prevent the magnetic material from being brought forcibly into contact with the central conductor during the stage or stages of the heat treatment when the deleterious action, whatever it may be, comes into play.

What is claimed is:

1. The method of loading a signaling conductor with magnetic material which requires heat treatment to give it a desired electrical characteristic, which comprises placing a layer of spacing material upon the conductor, placing the loading material upon the spacing material and subjecting the loaded conductor to the said heat treatment, the heat of which is great enough to destroy the layer of spacing material.

2. The method of loading a signaling conductor with magnetic material which requires heat treatment to give it a desired value of permeability, which comprises placing a layer of paper upon the conductor, placing the loading material upon the paper, and subjecting the loaded conductor to the said heat treatment, the heat of which is sufficient to destroy the layer of paper.

3. The method of loading a signaling conductor with magnetic material which requires heat treatment to give it high permeability, which comprises wrapping the conductor spirally with paper tape, wrapping the magnetic material in the form of tape spirally about the layer of paper, and subsequently subjecting the loaded conductor to the said heat treatment, the heat of which is great enough to destroy the layer of paper.

4. The method of loading a signaling conductor with magnetic material which requires heat treatment to give it a desired electrical characteristic, which comprises placing a layer of spacing material upon the conductor, placing the loading material upon the spacing material, and subsequently subjecting the loaded conductor to the said heat treatment in an atmosphere which will combine chemically with the layer of spacing material when heated to the temperature necessary for said heat treatment.

5. A method of loading a signaling conductor with magnetic material which requires heat treatment to give it a desired electrical characteristic, which comprises placing a layer of spacing material upon the conductor, placing the loading material upon the spacing material in the form of spirally laid wire or tape, and subsequently subjecting the loaded conductor to the said heat treatment, the heat of which is sufficient to remove the layer of spacing material, said spacing material being of such thickness that when removed the layer of loading material, when cold, will fit the conductor fairly closely but not so tightly that strains will be set up therein during the heat treatment by different rates of expansion or contraction of the conductor and loading material.

6. The method of obtaining a desired spacing between an electrical conductor and a metallic covering therefor, which comprises placing a layer of spacing material upon the conductor, placing the metallic covering upon the spacing material, and subsequently subjecting the conductor, so covered, to a heat treatment which destroys the layer of spacing material.

7. The method of obtaining a desired spacing between an electrical conductor and a cover therefor of magnetic material, which comprises placing a layer of spacing material upon the conductor, placing the magnetic material upon the spacing material and subsequently subjecting the covered conductor to a treatment which will cause the layer of spacing material to disintegrate.

8. The method of obtaining the desired spacing between an electrical conductor and a covering therefor of magnetic material which comprises placing a layer of spacing material upon the conductor, placing the magnetic material upon the spacing material and subsequently removing the spacing material.

In witness whereof, I hereunto subscribe my name this 1st day of December A. D., 1920.

WILLIAM B. TEN EYCK.