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ELECTRIC CABLE

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3 Claims. (Cl. 174—102)

This invention relates to electric cables having a taped form insulation and has for its object to lay the tapes so as to produce a cable having a maximum dielectric strength.

We have discovered that the maximum dielectric strength of a paper tape wrapped conductor is dependent upon staggering the tapes in their lay in such a manner that there will be a small number of radially aligned channels in the straight-through path combined with a long zig-zag path.

Dielectric strength tests have shown that insulation composed of layers of tape, breaks down along the weaker of two possible paths. One path is the zig-zag or stepped one around the edges of the tapes and between adjacent layers; the other is straight-through the tapes. There are, of course, many combinations of these types of paths often present in one failure. In either type of path, the dielectric strength depends to a large extent upon the length possible of path through the dielectric and the amount of the dielectric in the path. However, the spacing of tapes giving the longest zig-zag path gives the least dielectric in the straight-through path due to lining up of the spaces between adjacent turns of tape. Also, the spacing giving the strongest straight-through path gives the shortest zig-zag path.

In the manufacture of impregnated-paper-tape insulated cable, great effort has been expended to improve the paper taping machines to give uniformity and precision to the spacing of adjacent tapes. Also, it has been determined theoretically that a certain uniform stagger between adjacent tape layers gives a reasonably long zig-zag path with a very strong straight-through path.

The result is a cable having a fairly strong zig-zag path consisting of very uniform steps.

We have discovered however, that such a path is no stronger for short time dielectric tests than the weakest straight-through path, formed by staggering the adjacent layers in such a way, that the channel of one layer is directly under or over the center of the adjacent layers.

We propose, therefore, to combine a long zig-zag path with a straight-through path having a minimum number of radially aligned channels, by staggering the tapes non-uniformly. For instance, the following system of staggering is shown in Figure 1:

Tape No. 10 20 30 40 50 60 70 80 90
Percent stagger—25 50 75 50 25 50 75 50, etc.

For the purpose of this specification we define "stagger" as follows: "Stagger" is the ratio (1/L) in Figure 1. This is expressed in percent. Where L is the lay of the tape and 1 is the offset between adjacent tapes. All dimensions should be measured parallel to the axis of the cable conductor, and when progressing through the insulation should be measured consistently in one direction.

The foregoing and other features of our invention will now be described in connection with the accompanying drawing forming part of this specification in which we have illustrated our insulation in its preferred form after which we shall point out in the claims those features which we believe to be new and of our own joint invention.

In the drawing: The figure is a longitudinal view of a piece of our cable broken away to show the relative positions of the stepped tapes in the layers.

In the carrying out of our invention we insulate any conductor 101 with tape insulation 102 and cover all with a protective covering or sheath 103.

We propose to lay the tape form insulation non-uniformly so that there will be a minimum of radially aligned channels such as 42 and 82 along the line C—D and with a maximum length of the zig-zag path A. B. To accomplish this the first tape 10 is laid upon the conductor in a helical lay with the edge 11 forming an optimum width helical channel 12 along the length of the conductor. The second tape 20 is laid upon the first tape with a 25% overlap, so that the channel 22 is offset the channel 12 by ¼ the lay of the tape all along the length of the conductor. The third tape 30 is laid upon the second tape 20 so that the channel 32 is offset the channel 22 by ½ the lay of the tape 20. The fourth tape 40 is laid upon the third tape 30 so that the channel 42 is offset the channel 32 by ¾ of the lay of the tape 42, and so on. It is important that all the calculated offsets are measured parallel to the axis of the cable conductor consistently in one direction.

The leakage path AB owes its length to the alternate 50% stagger as will be seen by following the dotted line AB. The straight-through path CD owes its small number of aligned channels 42 and 82 to the non-uniformity of the staggers, that is, the 25 and 75% staggers which are alternated with the 50% staggers.

Such a system of staggering is found to be a decided improvement over the uniform stagger previously used.