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Dyba et al.

[11] **3,914,532**

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[54] **SECTOR CABLE**

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[52] **U.S. Cl.** ..... **174/119 R;** 174/110 P; 174/114 S

[51] **Int. Cl.²** **H01B 7/02**

[58] **Field of Search** ..... 174/114 S, 129 S, 110 P, 174/119 R; 162/138, 206

[56] **References Cited**

UNITED STATES PATENTS

2,187,213	1/1940	Milliken	174/114 S
2,624,245	1/1953	Cluett	162/206
3,662,092	5/1972	Franco	174/110 P

FOREIGN PATENTS OR APPLICATIONS

63,542	3/1949	Netherlands	174/114 S

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[57] **ABSTRACT**

A sector cable comprising a plurality of wedge-shaped, segments, composed of a plurality of compacted and twisted wire strands, arranged with side walls abutting and with the point of each wedge directed toward, but spaced from, the central axis of the cable, at least alternate segments covered on the exterior with an insulation covering comprising at least two layers of an extensible, flexible, and dense, uncreped paper, the insulated and uninsulated segments being so spaced in relation to each other that the side wall of any uninsulated segment does not abut the side wall of any other uninsulated segment.

3 Claims, 3 Drawing Figures

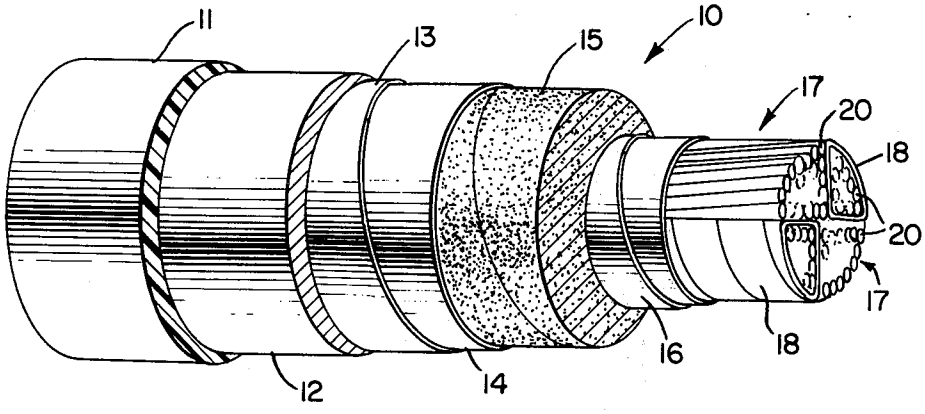


FIG. 1.

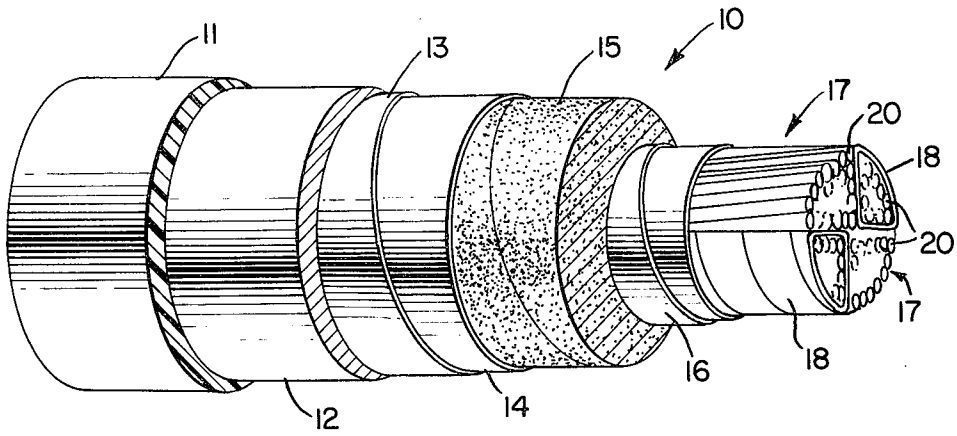


FIG. 2.

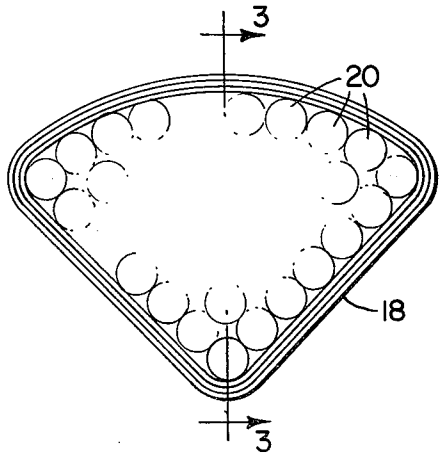
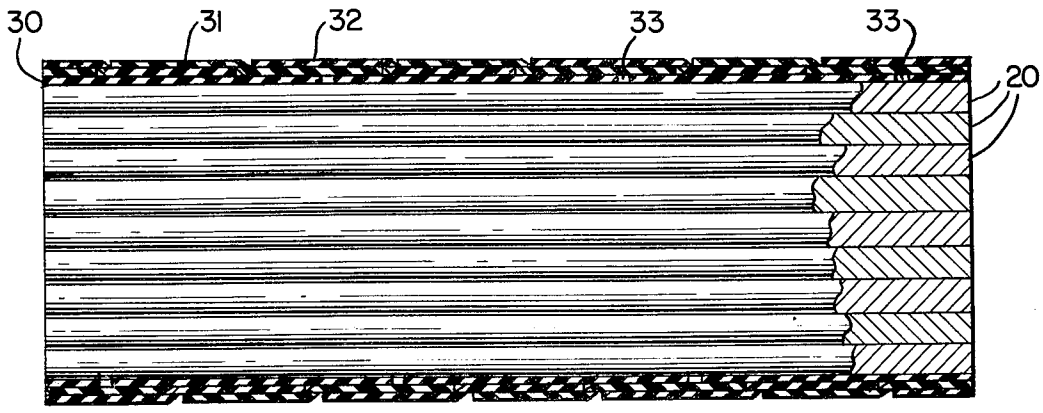


FIG. 3.



SECTOR CABLE

BACKGROUND OF THE INVENTION

Sector cables, also known as segmental conductor cables, are relied upon in systems with voltage ratings from 5,000 to 500,000 volts and require a conductor design capable of giving many decades of reliable service.

Such cables utilize a plurality of conductor segments, each of which is formed of a plurality of wire strands which are first compacted and then twisted, as in a standard cabling machine, to introduce a permanent twist into each segment so that the finished conductor will lay dead. In addition, in order to prevent shorts between conductor segments and current losses resulting from the distortion of the current distribution due to proximity to the other current carrying conductor segments it is necessary to insulate the individual segments. Not every segment need be insulated but at least a sufficient number are insulated so that the side wall of the uninsulated segment does not abut the side wall of any other uninsulated segment.

In forming the insulated segments the insulation covering is placed over the segment prior to the twisting operation. As is readily apparent the twisting operation requires a considerable amount of torque and over-twist to produce the desired set in the segment because the segments are in a medium-hard condition because of compaction. The insulator covering on the segment is thus first exposed to the over-twist and then to the die pressure in the bushing of the cabling machine which applies the torque. The over-twist places a high tensile load on the insulating covering which can, and does, cause breaks in the tape. In addition, the die pressure causes wear of the insulation covering, sometimes tears through the covering, at the corners of the segment where the bushing forces concentrate. Such breaks, wears, and tears can cause segment shorts which are obviously detrimental to the cable performance and operation.

Various insulation coverings have been tried in order to overcome this problem of shorting and current loss, such as paper made from hemp rope, nylon fabric tapes, and a combination of such nylon tape intercalated with a polyester tape, but none have been completely successful.

SUMMARY OF THE INVENTION

Sector cables have now been found in which there is no breakage in the insulating tape thereby substantially eliminating shorts between segments.

Briefly stated, the present invention comprises a sector cable comprising a plurality of wedge-shaped segments, composed of a plurality of compacted and twisted wire strands, arranged with side walls abutting and with the point of each wedge directed toward, but spaced from, the central axis of the cable, at least alternate segments covered on the exterior with an insulation covering comprising at least two layers of an extensible, flexible, dense uncreped paper, the insulated and uninsulated segments being so spaced in relation to each other that the side wall of any uninsulated segment does not abut the side wall of any other uninsulated segment.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a sector cable of the instant invention;

FIG. **2** is a sectional view of a single insulated segment forming part of the sector cable; and

FIG. **3** is a sectional view taken along line **3—3** of FIG. **2.**

DETAILED DESCRIPTION

Referring to the drawings, there is shown a sector cable **10** comprising an outer protector covering, usually of a polymeric material such as rubber, plastic, or the like, which overlies a lead sheath **12.** Immediately under sheath **12** is a semiconducting carbon black tape **13** intercalated with a copper shielding tape **14.** The copper shielding tape **14,** in turn, is placed over cable insulation (usually paper) **15** which is placed about strand shield **16.** The foregoing layers of material are those conventionally used in making sector cables and they are applied in their usual thicknesses.

Indicated as **17** are compacted conductor segments made of individual metal wire strands **20.** As illustrated in FIG. **1,** every other segmental conductor **17** is covered with an insulation covering **18.** In accordance with the instant invention at least alternate segments **17** must be covered on the exterior with the insulation **18.** If desired, all of the segments **17** can be covered with such insulation. It will be noted that insulated and uninsulated conductor **17** are so spaced in relation to each other that side walls of any uninsulated conductor does not abut the side wall of any other uninsulated segment in the cable **10.**

As best illustrated in FIG. **3,** it is preferred to use three layers of material in forming the insulation covering **18.** The first layer **30,** or innermost layer, placed on top of the metal wire strands of the segment **17** is wrapped around the segment with about a 5% butt space **33** between the edges of this innermost layer. The outer layers **31** and **32** are applied over this innermost layer with approximately 50% intercalation of these two layers. This butt space and intercalation permits, in conjunction with the required insulation material **18,** the twisting of the metal wire strands to form the finished segments without any wearing or tearing of the insulation covering **18.**

It is an essential feature of the instant invention that all three layers of the insulation covering **18** must be of an extensible and flexible, dense, uncreped paper. Such paper is described in detail in U.S. Pat. No. 2,624,245. It is characterized by having substantial extensibility well in excess of its primitive elastic limit in a direction parallel to its faces, the extensibility being continuous throughout it in the direction of extensibility and those fibers within the paper which extend generally lengthwise in the direction of extensibility being locally, laterally, and individually rearranged and undulating lengthwise within the paper.

The insulation papers **30, 31** and **32** are preferably in the form of tapes that are three-quarters of an inch wide and having a thickness of 5 mils. The tapes, **30, 31** and **32** are spiral wound onto the compacted segment **17** with the butt spacing and intercalation noted above.

After application of the three tape insulation covering **18,** the insulated segment is fed through a standard cabling machine of the type conventionally used for

this purpose and a permanent twist introduced into the segment.

The twisted insulated and uninsulated segments are then formed into the finished cable with the various protective coverings described in the usual manner; cabling procedures being well known to those skilled in this art.

It has been found that, with the insulation paper of the present invention, the high tensile load caused by overtwisting and the wear caused by the die pressure are eliminated. The elimination is caused not only by the nature of the paper itself and its ability to flex and extend under the tensile load and die pressure but also by the butt spacing and intercalation which permit the insulation tapes **30, 31,** and **32** to adapt to the tensile load and pressure without breaking or tearing. The result is a sector cable which is free of shorts.

The processing of the cable, aside from the application thereon of the insulating paper layer that has been extensively discussed, is that conventionally used in making a sector cable. More specifically, a standard cabling machine is used and the protective covering **11,** lead sheath **12,** carbon black tape **13,** copper shielding tape **14,** paper insulation **15,** and strand shield **16** are those conventionally used for this purpose and are placed thereon in the usual thickness and in the usual manner.

While the invention has been described in connection with a preferred embodiment, it is not intended to limit the invention to the particular form set forth, but, on the contrary, it is intended to cover such alternatives, modifications and equivalents as may be included within the spirit and the scope of the invention as defined by the appended claims.

What is claimed is:

1. A sector cable comprising a plurality of wedge-shaped segments, composed of a plurality of compacted and twisted wire strands, arranged with side walls abutting and with the point of each wedge directed toward, but spaced from, the central axis of the cable, at least alternate segments covered on the exterior with an insulation covering comprising at least two layers of an extensible, flexible, and dense uncreped paper, the insulated and uninsulated segments being so spaced in relation to each other that the side wall of any uninsulated segment does not abut the side wall of any other uninsulated segment, the innermost insulation layer is wrapped around the segments with about a **5%** butt space between the edge of the layer and at least one outer layer being applied over the innermost layer with approximately **50%** intercalation of said at least one outer layer.

2. The sector cable of claim **1** wherein the insulation covering comprises three layers of said uncreped paper.

3. A sector cable comprising a plurality of wedge-shaped segments, composed of a plurality of compacted and twisted wire strands, arranged with side walls abutting and with the point of each wedge directed toward, but spaced from, the central axis of the cable, at least alternate segments covered on the exterior with an insulation covering comprising at least two layers of an extensible, flexible, and dense uncreped paper, the insulated and uninsulated segments being so spaced in relation to each other that the side wall of any uninsulated segment does not abut the side wall of any other uninsulated segment, wherein the insulation covering comprises three layers of said uncreped paper, and wherein the innermost insulation layer is wrapped around the segments with about a 5% butt space between the edge of the layer and the outer two layers being applied voer the innermost layer with approximately 50% intercalation of said two outer layers.

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