July 28, 1936. J. J. MORRISON 2,049,073

CABLE

Filed March 21, 1933

Fig. 1.

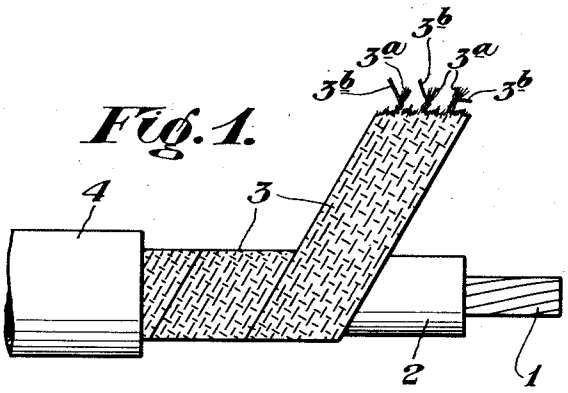


Fig. 2.

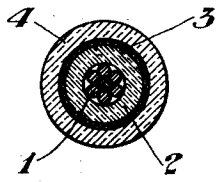


Fig. 3.

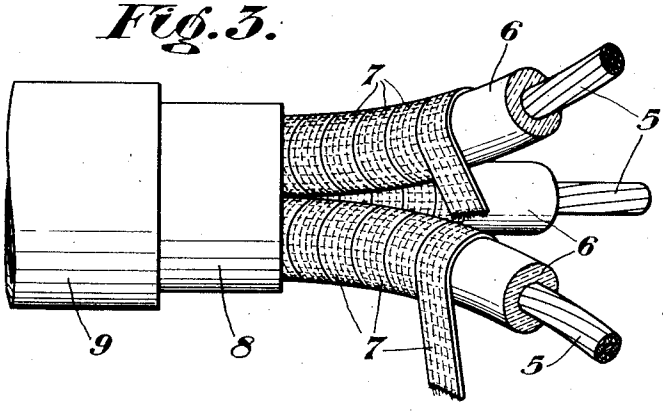


Fig. 4.

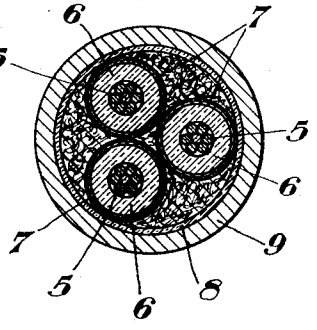


Fig. 5.

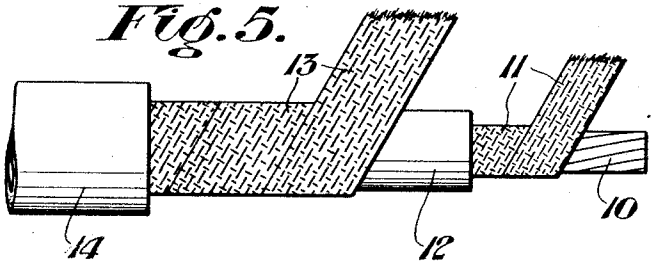
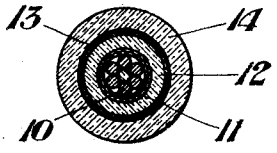


Fig. 6.



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UNITED STATES PATENT OFFICE

2,049,073

CABLE

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Application March 21, 1933, Serial No. 661,982

3 Claims. (Cl. 173—266)

This invention relates to electric cables, particularly when for high voltages; for example, operating at 2500 volts or higher.

In such high voltage cables it has become common practice to make use of a metallic shielding over the insulation on the conductor or conductors, in order that deterioration due to corona may be reduced to a minimum; such shielding being in the form of a metallic tape, either solid or woven, but relatively inelastic as compared with the insulation. With such type of shielding, any abrupt bend during the process of manufacture or during installation may cause deformation of the metal and result in voids or pockets between the shielding and the surface of the insulation, thus increasing the possibility of deterioration of the insulation at these spots. Moreover, during operation the cable is subject to cycles of expansion and contraction, resulting in additional loosening of the shielding on the surface of the insulation.

Remembering that the highly conductive metals are characterized by inelasticity, the reason for the above is obvious. For instance, copper tape, frequently used for shielding because of its desirable non-magnetic properties, has been found in practice to assume a permanent set when distorted beyond its rather low elastic limit. This naturally causes its separation from the underlying insulation when the latter returns to a normal shape, and results in the above undesirable conditions.

One of the objects of the present inventor is to eliminate or diminish this characteristic of shielded cables. This is done by providing a new and improved cable shielding. Generally speaking, this shielding includes a conductive material and a relatively elastic material, the length ratio and association of these two being arranged so the major portion of any strain applied to the shielding is applied to the elastic material. More specifically, it is a tape fabricated in whole or in part from relatively elastic strands having conductive wire helically wound thereon. Thus, the stretched length of the wire will exceed that of the elastic material. Any strains within the limits of cable handling and operation are taken by these elastic strands, while the wire merely coils or uncoils, under the resilient effect of the former, without any permanent distortion.

Experiments have demonstrated that a shielding of this new type, when applied to the surface of a conductor insulation, possesses the elastic properties of the strand elements, and will meet bending conditions in handling as well as the operating cycles of expansion and contraction, without being loosened or deformed, and that the shielding protection given by the metallic covering will be constant with consequent increased life for the cable.

While the application of the shielding in the form of a tape is advisable from the standpoint of ease of manufacture, it may be applied in the form of a wind, braid, or the like, without sacrifice of its valuable properties. Such a type of shielding is particularly adaptable to conductors insulated with rubber compound, since the tape may be applied to the surface of the rubber insulation before vulcanization, thereby securing maximum adhesion of the shielding to the surface of the rubber insulation during the vulcanizing process. This shielding may be saturated with a suitable impregnation possessing protective characteristics, thus providing additional shielding against deterioration of the insulation without detracting from the other desirable features produced by its use.

In the accompanying drawing, single and three-conductor constructions are shown, but this invention is applicable to any type or construction of cable in which shielding of the conductor insulation is desirable.

Figures 1 and 2 show the single conductor cable, Figures 3 and 4 the three-conductor one, and Figures 5 and 6 another single conductor cable to which the shielding is differently applied.

In Figures 1 and 2 the conductor, which may be either solid or stranded, is represented by 1; and the insulation around the conductor is shown as 2. The new shielding is represented by 3, in this case shown as applied in the form of tape, although its application may be in the form of a braid, wind, or other convenient means. The strands are numbered 3^a and the metal helically wound thereover as 3^b. The strands may be of cotton, and they need not necessarily all carry wire. 4 indicates the outer protective cover, which may be in the form of a lead sheath, tape, braid, wind, armor or any required combination of such covers.

Figures 3 and 4 show a three-conductor cable, although it must be understood that this method of shielding may be used on any number of conductors. In these an individual conductor, which may be either solid or stranded, is shown as 5, with its insulation 6. The new shielding is shown applied as a tape 7, although its application may be in other form, as cited above. 8 represents a binder tape over the cabled conductors, which are assembled with fillers of rubber,

fibrous material, such as jute, or other material commonly used for such purpose.

Where a lead sheath is to be applied over the assembled conductors, it is preferable that this tape be metallic in nature, in order to insure satisfactory grounding, but in other constructions an ordinary rubber filled tape will be satisfactory. 9 is the outer protective cover, which may be of lead sheath, fibrous braid or wind, tape, armor, or any required combination for insuring protection. It may also be desirable to place conducting strands in the interstices of any multiple conductor construction which will be in intimate contact with the shielding 7, and provide means for any heavy flow of current to ground.

Figures 5 and 6 show a further modification of the use of the new type of shielding, in which it is applied between the conductor and the inner surface of the insulation, as well as over the outer surface of the insulation. Here, 10 represents the conductor and 11 the inner shielding. 12 shows the conductor insulation, with the outer shielding 13. The outer protective cover or covers are indicated by 14.

By the use of the elastic shielding, as shown by 11, the possibility of void formations between the conductor and insulation during operating cycles of expansion and contraction, or from sharp bends in handling is decidedly reduced with consequent reduction in the possibility of internal corona cutting on the insulation. While shown in the single conductor construction, the use of the invention for an internal shield is also applicable in multiple conductor constructions.

I claim:

1. A high-voltage electric power cable including the combination of a conductor, insulation around said conductor, and shielding arranged in intimate contact with at least one of the surfaces of said insulation, said shielding including relatively elastic strands having conductive wire wound thereon so that it is sufficiently elastic to accommodate distortion of said insulation.

2. A high-voltage electric power cable including the combination of a conductor, rubber insulation around said conductor, and shielding arranged to protect said rubber insulation from the electrical effects caused by high-voltage currents carried by said conductor, said shielding being fabricated from conductive wire and an elastic material that are associated so that the stretched length of the former exceeds that of the latter, and said rubber insulation being vulcanized to said shielding so that there are no voids between the two.

3. A high-voltage electric power cable including the combination of a conductor, rubber insulation around said conductor, and shielding arranged to protect said rubber insulation from the electrical effects caused by high-voltage currents carried by said conductor, said shielding including relatively elastic strands having conductive wire wound thereon so that it is sufficiently elastic to accommodate distortion of said insulation, and said rubber insulation being vulcanized to said shielding so that there are no voids between the two.

JAMES J. MORRISON.