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ROT-RESISTANT INSULATED CABLE

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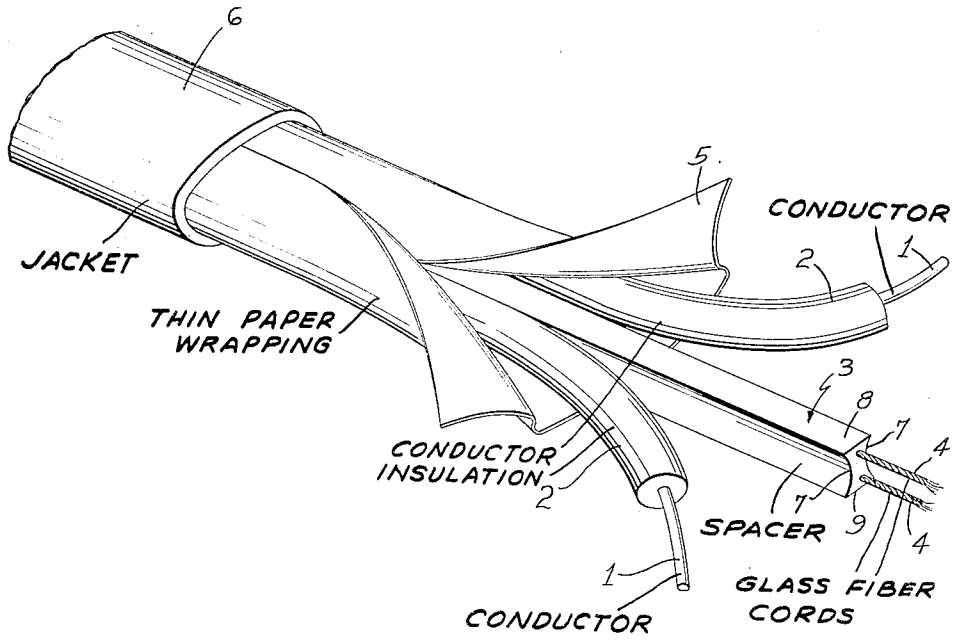

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ROT-RESISTANT INSULATED CABLE

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1 Claim. (Cl. 174—116)

1

This invention is directed to the provision of an improved insulated electrical cable especially suited for wiring in damp locations such as are frequently found in barns, lofts and cellars. The cable of the invention is designed to eliminate to a very large extent the fibrous material in the form of paper and cotton used in cables heretofore employed for wiring in these and other parts of buildings. These fibrous materials are particularly subject to attack by mold and other rotting agents in damp atmospheres. Cables in which they are extensively employed sometimes deteriorate by rotting over a period of years, to such an extent as to make the cable unsafe for current-carrying purposes.

The non-metallic parts of the new cable are made almost entirely of rot-resistant rubber or equivalent material. Such organic fibrous material as is employed is arranged so that it cannot be attacked by dampness and rotting agents to any appreciable extent, and so that even if it does become rotted, no injury will be done thereby to the cable. The construction of the cable is such as to achieve (1) maximum economy consistent with safety in the use of the rubber, (2) the full degree of mechanical strength and separation of conductors generally considered advisable for safe wiring, and (3) easy access to the conductors for the purpose of making electrical connections.

The cable of the invention comprises a plurality of metallic conductors, preferably arranged parallel to each other, and each individually insulated with a substantially cylindrical layer or rubber. An elongated rubber spacer is positioned between the conductors to maintain the metallic conductors spaced apart a distance greater than twice the wall thickness of the insulation layers. In addition, the cross-sectional shape and dimensions of the spacer are such that it serves as a filler for the valley spacer between the round insulated conductors. Substantially inextensible tensile-reinforcing cards, advantageously composed of glass fibers, are embedded in and extend throughout the length of the spacer. A very thin fibrous wrapping, advantageously of paper, directly surrounds the assembly of insulated conductors and spacers. A rubber jacket surrounds the assembly directly over this wrapping. The wrapping is preferably made adherent to the inner surface of the jacket, but not to the conductor insulation or spacer enclosed within it.

The wrapping under the rubber jacket is the only fibrous material subject to rotting employed

2

in the new cable, and its location, and especially its thinness and adherence to the jacket, effectively protect it from rotting in damp atmospheres. Even if it does become rotted or otherwise deteriorated, no important damage is done thereby to the cable. To some extent the fibrous wrapping holds the assembly of insulated conductors and spacer together during manufacture of the cable and prior to applying the rubber jacket (especially if the wrapping is helically wound in place), but its chief function is to facilitate removal of a short length of the jacket wherever the conductors must be exposed to make electrical connection.

The new cable is shown in cut-back section in the accompanying drawing. As there shown, the individual copper conductors 1 are each surrounded by a cylindrical extruded jacket 2 of rubber or equivalent composition. An extruded rubber spacer 3 positioned between the insulated conductor keeps the copper wire 1 spaced apart a distance greater than twice the wall thickness of the rubber insulation 2. Reinforcing cards 4 made of glass fibers are embedded in the spacer to increase the tensile strength of the cable. A thin wrapping 5 of paper or similar material is applied directly over the assembly of insulated conductors and spacer, and about this wrapping is an extruded rubber jacket 6.

To economize on rubber and to keep the cable as compact as possible, the wall thickness of the rubber insulation 2 is limited to about one-sixteenth inch. In view of the fact that the rubber jacket 6 provides further insulation about one thirty-second to one-sixteenth inch thick between each conductor and ground, such wall thickness for the insulation 2 is ample to prevent short circuits to ground for cables using, say, B. & S. gauge No. 12 or No. 14 copper wire as the conductor 1 and intended for ordinary house wiring circuits operating at 115 or 230 volts. However, it is necessary that the two conductors be positively maintained apart by an adequate distance to prevent any possibility of a short circuit between conductors even when the cable is sharply bent, or subjected to a severe blow, or otherwise deformed. The Underwriters' Laboratory regards a separation of about five thirty-seconds of an inch as necessary for safety. Usually this spacing is achieved in cables intended for the same service as the cable of the invention by surrounding the rubber-insulated conductors with a fabric braid that is impregnated with asphaltic compounds. Two such rubber-insulated and braid-covered conductors

may be laid side by side and the metallic conductors will still be adequately separated. There is no braid about the rubber insulation 2 of the new cable, however, and if the two conductors are laid side by side with their layers of insulation in contact, the spacing between conductors will be inadequate. By the provisions of the spacer 3, which keeps the insulated conductors positively separated, an adequate safe spacing is maintained while still achieving the benefits of economy of rubber and compact design that follow from the use of a rather thin insulation layer 2.

Another necessary feature of safe cable for ordinary wiring purposes is adequate tensile strength. The Underwriters' Laboratory considers a tensile strength of at least 300 pounds necessary for cable for building wiring. Two No. 14 copper conductors (a usual size for building wiring) do not in themselves have quite sufficient tensile strength to meet this requirement. The fabric braid about the rubber insulated conductors of ordinary non-metallic sheathed cable, and the jute fillers in the valley spaces between conductors of such cable, supplement the strength of the copper conductor enough so that such cable possesses adequate tensile strength even though the copper conductors alone do not. In the new cable there are no braids or fibrous fillers to supplement the tensile strength of the conductors, but this lack is met by providing the tensile-reinforcing cords 4 embedded in the spacer 3. These cords, which extend throughout the length of the spacer, are advantageously composed of glass fibers, because such cords possess greater tensile strength than cords of similar size of conventional textile fibers and because they are not susceptible to rotting or other damage in damp atmospheres.

In addition to maintaining adequate separation between the conductors and serving as carrier for the reinforcing cords, the spacer 3 is designed to perform the further function of filling the valley spaces between the round insulated conductors. To this end its sides 7 are made concave to an extent approximately equal to the convexity of the outer surfaces of the layers of insulation 2; i. e. the radius of curvature of the concave sides 7 of the spacer is about equal to the radius of curvature of the outer surfaces of the insulation 2. The height of the spacer from top 8 to bottom 9 is about equal to the diameter of the insulation 2 about each conductor, so that the top and bottom edge portions of the spacer are substantially wider than the central portion, and are of the proper shape to fill the valley spaces between the conductors.

The fibrous wrapping 5 is primarily for the purpose of making it easy to strip a portion of the jacket 6 from the conductors wherever it is desired to expose them for making electrical connections. It may be wrapped longitudinally about the assembled conductors, as shown, or may be wound helically about them. (In the latter case, it also helps hold the assembly of insulated conductors and spacer together during manufacture of the cable and before extrusion of the jacket 6.) It must be thin so that it will present negligible cross-sectional area at the ends of the cable where it might absorb moisture. In this way it is quite well protected from attack by rotting agents. Its thickness therefore should not exceed about 0.005 inch, and it should have its inner surface tightly in contact with the assembly of insulated conductors and spacer, and its outer surface tightly in contact with the jacket 6. It is preferably made of a paper that will adhere to the inner surface of the jacket 6 when the latter is applied. For this purpose it may be composed of paper that has been treated chemically to render it adhesive to the jacket when the latter is applied and vulcanized (but not adhesive to the already vulcanized layers of conductor insulation and spacer), or it may be of paper having a somewhat fuzzy surface which becomes physically bonded to the rubber of the jacket when the latter is applied and vulcanized over the previously vulcanized conductor insulation and spacer. Adhesion of the wrapping 5 to the inner surface of the jacket 6 is desirable both to insure protection of the wrapping against rot and to make it easily removable with the jacket when the latter is stripped off.

The paper wrapping 5 is the only organic fibrous material employed in the new cable which is subject to damp rot, and its thinness and adhesion to the rubber jacket 6 together provide very effective protection against absorption of sufficient moisture to promote rot or like deterioration even when the cable is installed in persistently damp locations. Even if it should be attacked by rot, however, no important damage is thereby done to the cable, because the wrapping does not contribute significantly to either electrical insulation or mechanical strength. The rubber components and reinforcing cords which serve these purposes are not subject to deterioration in this manner.

In the foregoing specification and in the appended claims the term "rubber" is used to denote not only composition of natural rubber, but composition of synthetic rubber and rubber-like materials as well. In fact, natural rubber compositions are not so desirable to employ in cables of the best quality as compositions of "Neoprene" (a synthetic rubber composed of polymerized chloroprene). Composition of other synthetic rubbers such as butyl rubber (a copolymer of isoprene and isobutylene) and "GR–S" rubber (a copolymer of butadiene and styrene), and of such rubber-like substances as "Koroseal" (polymerized vinyl chloride) also may be employed.

I claim:

Rot-resistant cable suitable for wiring in damp locations comprising a pair of metallic conductors arranged substantially parallel to each other and each individually insulated with a substantially cylindrical layer of rubber; an elongated rubber spacer positioned between said insulated conductors, said spacer being of a height approximately equal to the outside diameter of the cylindrical layers of insulation and having both sides concave to an extent substantially equal to the convexity of the outer surfaces of said cylindrical layers of insulation, said spacer maintaining the metallic conductors spaced apart a distance greater than twice the wall thickness of said insulation and the top and bottom portions of said spacer serving as fillers for the valley spaces between the insulated conductors; and a sheath thereover, said sheath consisting of a thin paper wrapping less than 0.005 inch in thickness directly surrounding the assembly of insulated conductors and spacer and in substantially continuous contact with the entire peripheral surface thereof, and a rubber jacket surrounding the assembly directly over said paper wrapping, said paper wrapping being tightly adherent over substantially its entire area to the

inner surface of the jacket but being non-adherent to the underlying layers of insulation and spacer; the spacer and the insulation of the conductors being individually vulcanized and hence non-adherent to each other or to the paper wrapping with which they are in contact.

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