DOUBLE-SHIELDED ELECTRIC CABLE

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This invention relates to improved electric cables and more particularly it relates to electric cables having an improved metallic shield construction.

It has become common practice in the fabrication of electric cables, particularly communication cables, to form an adhesive or adhesive bond between the metallic shield and outer polymer jacket. Although such an adhesive bond construction offers advantages in producing cables which are substantially impervious to moisture, the same construction presents difficulties when such cables must be spliced and joined. If a strong bond exists between the polymer jacket and metallic shield, it is extremely difficult to separate the jacket from the shield to prepare the cable for joining. The separation of the jacket from the shield in the field may be so time-consuming as to discourage the use of the bonded construction. Furthermore, the metallic shield is often damaged in the area of the joint thereby reducing the effectiveness of the cable. One method of avoiding the above problem has been to decrease the strength of the adhesive bond between the polymer jacket and metallic shield; however, this makes the bond less reliable and subject to deterioration with age so that the cable becomes less resistant to moisture penetration. It would therefore be highly desirable to produce an electric cable having a construction which would permit the removal of the outer polymer jacket without damaging the inner metallic shield.

In accordance with the present invention, there is provided an electric cable having an improved metallic shield construction which comprises, (1) a cable core of at least one insulated metallic conductor, (2) a first metallic shield surrounding the cable core, (3) a second metallic shield surrounding the first metallic shield, said second shield having a thickness less than that of the first metallic shield, and (4) an outer jacket of a thermoplastic material surrounding the second shield, the second shield being firmly and adhesively bonded to the outer jacket.

The invention will be better understood from the accompanying drawings and following description.

FIGURE 1 is a schematic view of a side elevation of a cable employing the double-shielded construction of the present invention.

FIGURE 2 is a schematic view of a side elevation of a cable construction similar to that of FIGURE 1 except that the shielding layers are corrugated.

Referring to the drawings, in FIGURE 1, a cable core 1 of conventional design having at least one insulated metal conductor is bound with a binder tape 2 and the tape 2 is surrounded by a plastic layer 3. The plastic layer 3 is surrounded by a first metallic shield 4 and is preferably bonded thereto. A second metallic shield 5, having a thickness less than that of the first shield 4, surrounds shield 4. An outer polymer jacket 7 of conventional design surrounds the second shield 5 and is adhesively and co-extensively bonded thereto at the interface 6. The adhesive bond may be obtained by using any suitable adhesive; however, it is preferred that an adhesive thermoplastic polymer be employed, e.g., a copolymer of ethylene and an ethylenically unsaturated carboxylic acid.

Although jacket 7 is securely bonded to shield 5, it may also be desirable to apply a thin layer of a viscous, weakly adherent material, e.g., bitumen, between the first shield 4 and the second shield 5 to make the cable less susceptible to moisture penetration. The bitumen layer does not interfere with jointing operations and jacket 7 and shield 5 can be easily removed without damage to the inner shield 4.

In the drawing, the metallic shields 4 and 5 are shown as longitudinally folded with a simple overlapped seam, but it will be understood that other seams, e.g., double crimped, may be used and either or both of the shielding tapes may be helically laid.

In another embodiment of the present invention a cable is constructed the same as described above except that the plastic layer 3 is omitted and the metal shield 4 is folded directly over the binder tape 2.

In FIGURE 2, a cable core 11 of conventional design having at least one insulated metal conductor is bound with a binder tape 12 and the tape 12 is surrounded by a plastic layer 13. The plastic layer 13 is surrounded by a first metallic corrugated shield 14 and is preferably bonded thereto. A second metallic corrugated shield 15, having a thickness less than that of the first shield 14, surrounds shield 14. An outer polymer jacket 17 of conventional design surrounds the second shield 14 and is adhesively and co-extensively bonded thereto at the interface 16.

The metals employed in the form of plain or corrugated sheets or foils as shielding elements for cables in accordance with the invention include aluminum, copper, copper-bronze, copper-clad steel, tin plated steel, galvanized iron and the like.

The outer polymer jacket is adhesively bonded to the adjacent inner metallic shield by means of an adhesive thermoplastic composition such as a copolymer of ethylene and an ethylenically unsaturated carboxylic acid. This adhesive composition provides an excellent bond between the jacket and metallic shield, said bond being highly resistant to moisture and, more important, the bond resists failure when subjected to uneven stresses. The outer polymer jacket may contain fillers such as carbon black where such fillers are desirable to make, for example, semi-conducting jackets.

The particular double-shield cable construction of the present invention offers the important advantage, during jointing operations, of one being able to remove the outer jacket without damaging the inner metallic shield. In jointing such a cable, the outer jacket being bonded to the adjacent thin metallic shield can be easily removed from a cable end by making a transverse cut to the appropriate depth around the cable. Removal of the jacket and shield exposes the inner metallic shield so that the required connection to form a joint to an adjacent cable can be made.

The following examples are illustrative of the present invention and are not intended to limit the scope thereof.

EXAMPLE 1

A thin layer of high density polyethylene 50 mils thick, is extruded over a strand of multi-pair conductors. An aluminum tape 8 mils thick, having a thin layer of a copolymer of ethylene and acrylic acid (8 percent by weight) applied to one side thereof, is longitudinally folded around the layer of polyethylene with the copolymer layer innermost. The aluminum tape is subjected to heat of about 140° C. to effect the bond between the aluminum and the polyethylene layer. A thin coating of bitumen about 1 mil thick is applied to the surface of the aluminum. An aluminum tape 2 mils thick, having a layer of a copolymer of ethylene and acrylic acid on one side thereof, is longitudinally folded about the bitumen-covered aluminum layer, the copolymer layer being outer-
An outer polymer jacket of polyethylene containing 2.5 percent by weight carbon black is extruded over the copolymer-coated aluminum tape, the heat of extrusion being sufficient to effect the adhesive bond between the polyethylene and the adjacent aluminum shield.

**EXAMPLE 2**

A strand of multi-pair conductors is wrapped with a binder tape to hold them together. A corrugated copper tape 5 mils thick is longitudinally wrapped around the binder tape. A corrugated stainless steel tape 0.5 mil thick, having a thin layer of a copolymer of ethylene and acrylic applied to one side thereof, is longitudinally folded around the inner copper tape, the copolymer layer being outermost. An outer polymer jacket of polyethylene containing 2.5 percent by weight carbon black is extruded over the copolymer-coated stainless steel tape, the heat of extrusion causing the polyethylene to become bonded to the stainless steel tape through the intermediate copolymer layer.

In place of the particular metals employed in the foregoing examples, other metals as hereinbefore defined are used with substantially the same results.

What is claimed is:

1. An electric cable having an improved metallic shield construction which comprises (1) a cable core of at least one insulated metallic conductor, (2) a first metallic shield surrounding the cable core, (3) a second metallic shield surrounding the first metallic shield, said second shield having a thickness of less than one-half the thickness of the first metallic shield, there being an absence of bonding between said first and second metallic shields and (4) an outer jacket of a thermoplastic material surrounding the second shield, the second shield being firmly and adhesively bonded to the outer jacket.

2. The cable according to claim 1 wherein the first and second metallic shields are of aluminum.

3. The cable according to claim 1 wherein the first and second metallic shields are corrugated.

4. The cable according to claim 3 wherein the first metallic shield is of copper and the second metallic shield is of stainless steel.

5. An electric cable according to claim 1 comprising (1) a cable core of at least one insulated metallic conductor, (2) a first metallic shield of aluminum 8 mils thick surrounding the cable core, (3) a second metallic shield of aluminum 2 mils thick surrounding the first aluminum shield, said second shield having a thin layer of a copolymer of ethylene and acrylic acid applied to the outermost surface thereof and (4) an outer jacket of polyethylene bonded to the second aluminum shield, said polyethylene containing 2.5 percent by weight conductive carbon black.

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