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ALUMINUM SHEATHED CABLE

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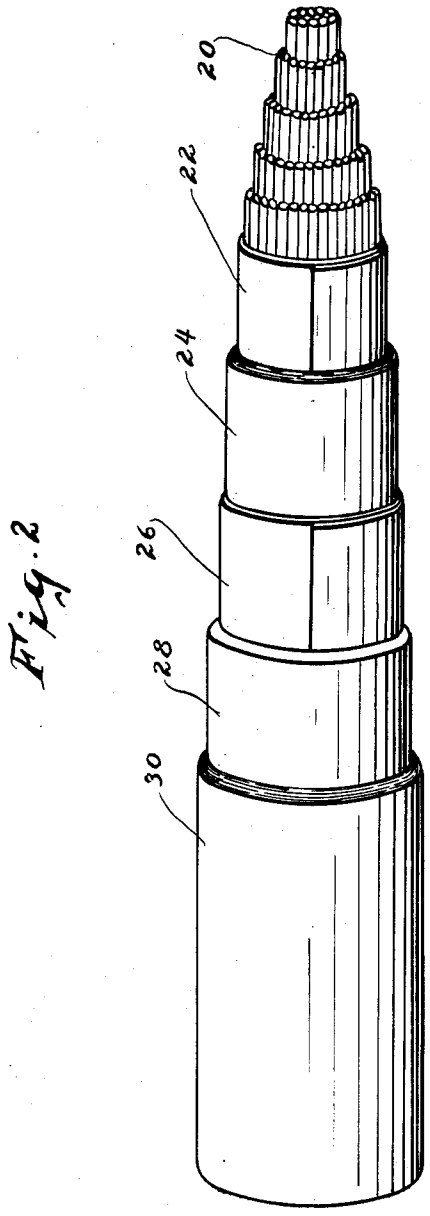


Fig. 2

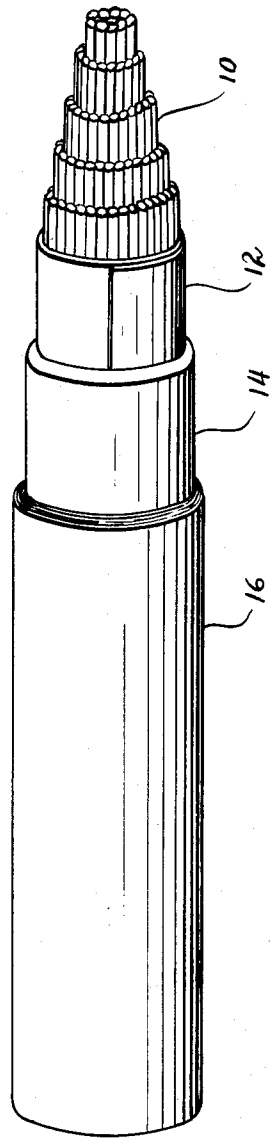


Fig. 1

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ALUMINUM SHEATHED CABLE

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This invention relates to sheathed cable, and, more particularly, to a cable construction having an extruded aluminum sheath.

Cables, such as telephone cable, having an extruded lead sheath for mechanical and electrical protection of the cable components enclosed thereby are known to the art. Lead has a number of advantages rendering it suitable for this application, particularly the capability of being extruded at temperatures just slightly over 300° centigrade. However, lead has certain disadvantages. It has a high specific gravity, making the resultant cable unduly heavy. Further, lead has a relatively low tensile strength and is relatively inelastic.

Substitute sheath designs having general acceptance have been the sheath designs known in the art as the Alpeth and Stalpeth sheaths, which were originally designed to alleviate lead shortages, which are now used on design merits.

The Alpeth sheath comprises a transversely corrugated aluminum tape (8 mils thick in most applications), placed longitudinally over the cable core with an overlapping seam which is filled with a polyisobutylene cement. An extruded polyethylene outer jacket is bonded to the aluminum by a flooding of rubber thermoplastic cement. The Stalpeth sheath design comprises a similar corrugated aluminum sheath, over which is applied in similar fashion a corrugated steel sheath with an overlapped soldered seal. A flooding component covers the steel sheath and there is an extruded polyethylene outer jacket.

In the Alpeth sheath the desired continuous metallic sheath for protection of the components enclosed thereby is not afforded, and this result is accomplished in the Stalpeth sheath only by reason of addition of the soldered steel jacket. Further, the designs require a plurality of manufacturing steps in cable assembly which are costly and are time consuming.

It is therefore desirable to provide a sheath of continuous wall which can be applied to the cable by a process similar to the application of lead sheathing. The advantages of an integral metallic sheath such as an aluminum sheath applied over the cable core components have been recognized by the art. Since aluminum necessarily is extruded at a higher temperature than lead, and since direct extrusion on the insulating material such as polyethylene now used by the art would melt the polyethylene, the art has resorted to formation of an aluminum conduit larger in size than the cable. The cable core is drawn into the preformed conduit, which then is reduced by cold die drawing until it forms a sheath in contact with the cable core. The reduction of the aluminum conduit workhardens the aluminum to the extent that the desired optimum softness and flexibility of the aluminum are lost.

It is, therefore, one object of this invention to provide cable construction in which the cable core is enclosed by a protective soft, annealed aluminum sheath of optimum flexibility.

It is a further object of this invention to provide an aluminum sheathed cable construction in which the aluminum sheath is extruded directly over the cable core insulation without any damage to the core due to deformation of the plastic insulation.

In accordance with these objects, there is provided, in a preferred embodiment of this invention, a cable having

a core composed of a plurality of insulated conductors. A laminated tape which for convenience will sometimes be referred to herein simply as "GRS-Mylar" tape is wrapped over the core. This laminated tape consists of a surface layer of butadiene styrene copolymer synthetic rubber of the type commonly known as "GRS" (A.S.T.M. "Symposium on the Applications of Synthetic Rubbers," Cincinnati spring meeting, March 2, 1944, page 13, published 1944, by American Society for Testing Materials, Philadelphia, Pennsylvania), and a surface layer of polyester produced from the condensation polymer of ethylene glycol and terephthalic acid and widely sold under Du Pont's trademark "Mylar" (Modern Plastics, vol. 33, No. 3, November 1955, opening paragraph of feature article entitled "Mylar Polyester Film Earns Its Title: Mighty Beauty," reprints distributed by E. I. du Pont de Nemours & Company under date of December 14, 1955). Contrary to usual practice, the tape is wrapped with the Mylar surface on the inside, against the core, and the GRS layer on the outside. An aluminum sheath of required purity and wall thickness for the application intended is directly extruded over the GRS-Mylar tape in contact therewith to complete the cable.

In another embodiment of this invention, the insulated conductors are bundled in a core around which is wrapped an insulator tape, such as paper or GRS-Mylar. A thermoplastic insulating jacket of high dielectric strength, such as polyethylene, is extruded over the core tape wrap. GRS-Mylar tape is wound over the polyethylene jacket to provide a heat barrier protecting the jacket. Contrary to usual practice the tape is wrapped with the Mylar surface on the inside, against the jacket and the GRS layer on the outside. An aluminum sheath of required purity and wall thickness for the application intended is directly extruded over the GRS-Mylar tape in contact therewith to complete the cable. Protective coverings such as extruded jackets, jute wraps, and armoring can be applied over the aluminum.

The invention may be more easily understood by reference to the following description taken in conjunction with the accompanying drawings of which:

FIGURE 1 is a telescopic view of one embodiment of this invention; and

FIGURE 2 is a telescopic view of another embodiment of this invention.

In FIGURE 1 there is shown a cable core comprising a plurality of insulated conductors **10** such as polyethylene insulated copper conductors. Polyethylene is a semi-rigid, waxy, translucent synthetic resin having excellent dielectric properties, moisture resistance and chemical stability. However, it is heat sensitive and deforms readily at temperatures of discontinuous metal sheath extrusion, a fact which has inhibited use thereof by the art. Alternative thermoplastic insulating materials are similarly damaged by heat, such as the heat from an extruded aluminum jacket.

To protect the core against heat damage, a layer of a non-hygroscopic tape **12** is wound over the jacket.

The tape **12** is preferably GRS-Mylar tape wrapped on the jacket with the Mylar positioned on the inside (e.g. in contact with the jacket), which is contrary to normal practice. The tape provides a heat barrier protecting the polyethylene jacket from the heat of the extruded aluminum jacket and has the additional advantage of increasing the dielectric breakdown voltage between the core conductors and the sheath. By wrapping with the Mylar surface on the inside, curling of the Mylar during application of the extruded sheath is avoided, and the GRS layer next to the aluminum sheath gives the required heat insulation to prevent damage to the core during extrusion. The materials from which this tape

is made have high dielectric strength and the tape functions also to insulate the core electrically from the aluminum sheath and thus give protection against damage by lightning.

A tape of 16-mil thickness formed of a 1-mil Mylar tape to which is applied a 15-mil GRS layer has been found satisfactory to provide the requisite heat barrier and sufficient dielectric strength.

Over the tape there is extruded an aluminum sheath **14** of the alloy and dimensions dictated by the application intended. The aluminum is extruded in manner similar to that of lead extrusion except higher operating temperatures and pressures in the extrusion press are encountered. The sheath is extruded directly onto the tape which serves as a heat barrier preventing damage to the polyethylene jacket, such as melting the polyethylene jacket by the heat of the extruded aluminum sheath. Thus, the sheath is for all practical purposes, a completely annealed, soft and flexible sheath and, since reduction of the sheath diameter is not required, no work hardening of the sheath occurs before the cable is placed in use. The high dielectric strength of the GRS-Mylar tape improves cable performance as well as serving as a heat barrier.

The extruded aluminum sheath electrically and mechanically protects the core components since it is an integral metallic sheath completely enclosing the cable core. Since the aluminum can be applied to finished dimensions in a single manufacturing operation, no further operating steps are necessary in cable manufacture and continuous line conditions can be established. Thus, the plurality of manufacturing steps necessary to fabricate the Alpeth and Stalpeth alternative sheaths are eliminated.

A polyethylene jacket **16** may be extruded over the aluminum sheath if the application so dictates.

In many applications the embodiment shown in FIGURE 2 may advantageously be employed.

In FIGURE 2 there is shown the cable core **20**. The conductors are assembled or bundled to form a cable core over which is wrapped insulating tape **22**, such as paper or GRS-Mylar tape.

Over the core tape wrap there is extruded a thermoplastic insulating jacket **24** of high dielectric strength, such as polyethylene, to insulate the core from the external sheath for such purposes as lightning protection.

To protect the jacket, a GRS-Mylar tape **26** is wrapped on the jacket with the Mylar positioned on the inside (e.g. in contact with the jacket), which is contrary to normal practice. As with the embodiment of FIGURE 1, the tape provides a heat barrier and increases the dielectric strength of the insulation layer between core and sheath.

An aluminum sheath **28** is extruded directly onto the tape. A jacket **30** may be extruded over the sheath.

It may be noted that this invention may be variously embodied and modified within the scope of the subjoined claims.

What is claimed is:

1. A telephone cable comprising a core composed of heat-sensitive plastic insulated conductors, a laminated tape wrapped over said core, said tape consisting of a layer of butadiene styrene copolymer synthetic rubber and a layer of polyethylene terephthalate polyester, said tape being wrapped with the polyester surface thereof in direct contact with the heat-sensitive plastic insulated conductors of the core, and a soft, fully annealed, extruded aluminum sheath over and directly on the synthetic rubber surface of said tape.

2. A telephone cable comprising a core composed of plastic insulated conductors, a core tape wrapped on said core, an insulating jacket of high dielectric strength heat-sensitive material extruded over the core tape wrap, a laminated tape wrapped over said jacket, said laminated tape consisting of a layer of butadiene styrene copolymer synthetic rubber and a layer of polyethylene terephthalate polyester, said tape being wrapped with the polyester surface thereof in direct contact with the said jacket, and a soft, fully annealed, extruded aluminum sheath over and directly on the synthetic rubber surface of said tape.

3. A cable comprising a core composed of insulated conductors, a polyethylene jacket extruded over the core of the cable, a laminated tape wrapped over said jacket, said tape comprising a layer of butadiene styrene copolymer synthetic rubber and a layer of polyethylene terephthalate polyester, said tape being wrapped with the polyester surface thereof in direct contact with the said jacket, and a soft, substantially completely annealed aluminum sheath over and in contact with said tape.

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