United States Patent [19]

Garshick

[11] **3,794,750**

[45] **Feb. 26, 1974**

[54] **SHIELDED CABLE**

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[73] Assignee: **Boston Insulated Wire & Cable Co.,** Boston, Mass.

[22] Filed: **July 27, 1973**

[21] Appl. No.: **383,185**

[52] **U.S. Cl.** ..... **174/36,** 174/107, 174/115, 174/126 CP

[51] **Int. Cl.** **H01b 11/06**

[58] **Field of Search** .. 174/36, 102 R, 105 R, 106 R, 174/107, 108, 109, 113 R, 115, 126 CP, 117 F, 117 FF

[56] **References Cited**

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Primary Examiner—Bernard A. Gilheany
Assistant Examiner—A. T. Grimley
Attorney, Agent, or Firm—Kenway & Jenney

[57] **ABSTRACT**

A shielded electric cable is described in which drain wires are incorporated into a shielding tape consisting of a metallic foil bonded to a non-conductive base strip. In one form, the drain wires are held in contact with the foil surface by fixing them between the foil and the base strip. The shielding tape is helically or longitudinally wound around the insulated conductors to provide a continuous conductive shielding surface. At the terminal point, the exposure of one or more drain wires provides a convenient connection from the foil to a grounding terminal.

6 Claims, 6 Drawing Figures

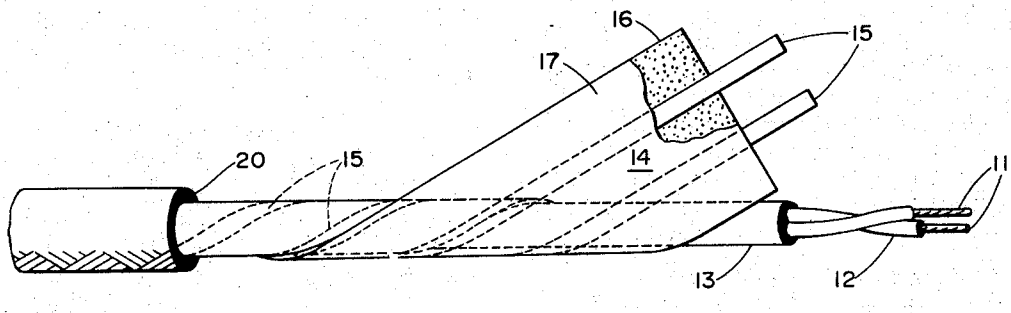


FIG. 1

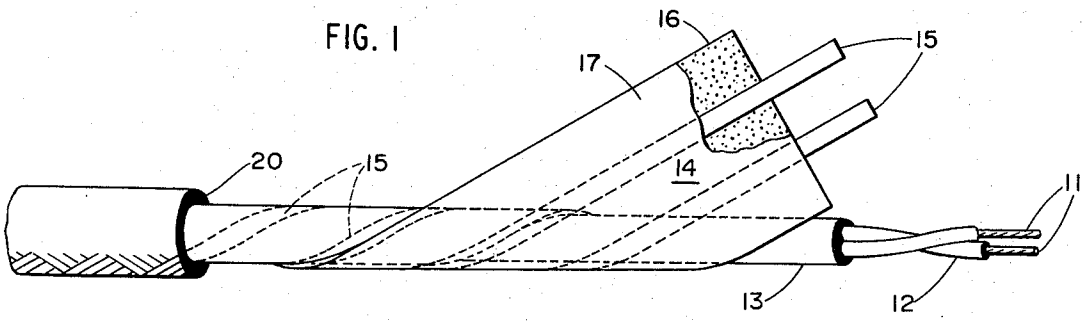


FIG. 2

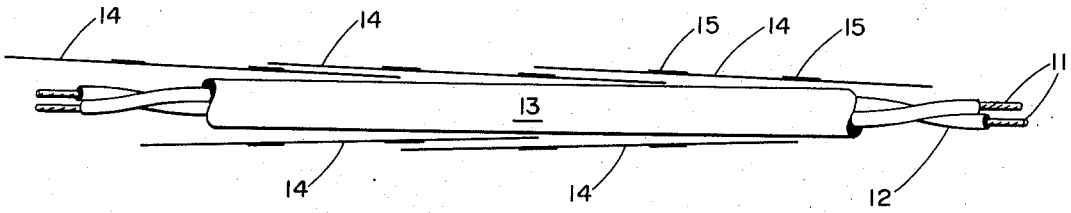


FIG. 3

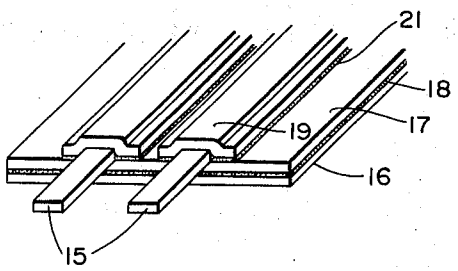
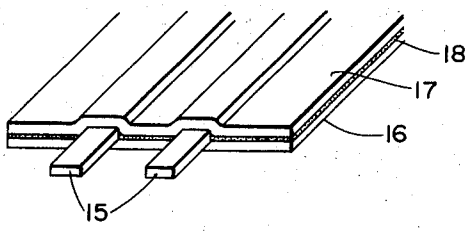


FIG. 4



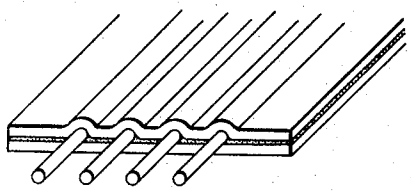


FIG. 5

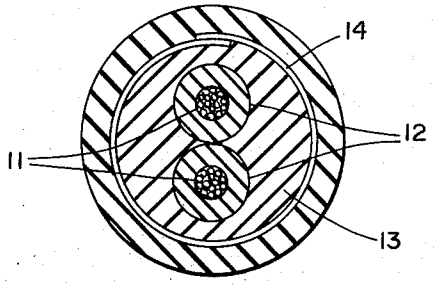


FIG. 6

SHIELDED CABLE

BACKGROUND OF THE INVENTION

This invention relates in general to electric cables and more specifically to shielded cables utilizing a continuous metallic surface as a shield. In electronics applications it is frequently desirable to shield a conductor in order to eliminate external electromagnetic interference, and in high voltage applications, to provide a ground for leakage currents. It is known in the art that shields consisting of a continuous metallic foil are more effective for these purposes than braided wire shields, but the use of a foil shield raises the problem of providing means to ground the foil layer. The present art provides a drain wire as an additional component within the cable located adjacent to the conductive surface of the shield. This arrangement, however, has a serious disadvantage in that the mechanical stresses of handling and installation, especially any flexing of the cable, will cause the drain wire to dig into the insulation. This in turn can result in voltage failures, the physical displacement of other components within the cable, and, at times, the total loss of electrical contact between the foil layer and the drain wire. These problems can also arise from the mechanical stresses of manufacturing operations such as the application of external insulation or thermally vulcanized jackets.

SUMMARY OF THE INVENTION

This invention overcomes these problems by incorporating a drain wire, or plurality of drain wires, into a laminated shielding tape which is wound around the conductor to be shielded. The shielding tape includes a metallic foil bonded to a non-conductive base strip and one or more drain wires fixed between the foil and the base strip. In another embodiment, the drain wires are bonded to the opposite side of the foil layer by additional non-conductive strips. At the termination point, the imbedded drain wire is separated from the foil and connected to a grounding terminal.

A principal object of this invention is to provide a shielded cable with the drain wires incorporated into the shielding so that flexing and other stresses do not damage the insulation or otherwise impair the effectiveness of the cable.

A further object of this invention is to provide a foil laminate shielding tape which may be helically or longitudinally wound around the conductors.

Still a further object of the invention is to provide a foil laminate shielding tape which maintains intimate contact with a drain wire.

These and other objects of this invention may be fully understood from the following detailed description, which should be read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cut-away view of one embodiment of a shielded cable constructed in accordance with this invention.

FIG. 2 is a side elevation in partial cross section of the shielded cable shown in FIG. 1.

FIG. 3 is a view of one embodiment of a shielding tape constructed in accordance with this invention.

FIG. 4 is a view of another embodiment of a shielding tape constructed in accordance with this invention.

FIG. 5 is a view of still another embodiment of a shielding tape constructed in accordance with this invention.

FIG. 6 is a view in cross section of another embodiment of a shielding cable constructed in accordance with this invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the embodiment shown in FIGS. 1 and 2, a pair of elongated wire conductors 11 are protected by inner sheaths of insulation 12. An insulation filler 13 surrounds the conductors and serves to insulate and to geometrically stabilize the conductors 11. The outer surface of the filler layer 13 is preferably uniform and approximately, but not necessarily, circular. A foil laminate shielding tape 14 is helically wound around the filler 13 so that the conductors 11 are surrounded by a continuous conductive shield. An overlap in the windings is recommended to guarantee shield integrity. Integral with the shielding tape 14 are two elongated, mutually parallel drain wires 15. The drain wires 15 are bonded between a non-conductive base strip 16 and a metallic foil 17 which acts as the conductive surface of the shield. The drain wires 15 are in continuous electrical contact with the foil 17 and provide a convenient connection from the foil shielding surface to a grounding terminal. The foil tape shield 14 is further enclosed by an outer layer 20 which electrically insulates and protects against physical or atmospheric damage. A suitable outer layer may consist of an extruded covering or a glass braid with a finish such as silicone or polyimide lacquer.

In the embodiment shown in FIG. 3, the drain wires 15 are incorporated into the shielding tape 14 by bonding them to the surface of the metallic foil 17 opposite to the non-conductive base strip 16. Bonding is accomplished by means of holding strips 19, which cover the drain wires 15 and are bonded to the foil 16 on both sides of the drain wires 15 by a strippable adhesive layer 21. The bonding strips 19 may consist of the same material as the base strip 16. When this embodiment is employed, the drain wires 15 are exposed for grounding by removing a portion of the holding strips 19.

FIG. 4 shows a cross section of the shielding tape 14 employed in FIGS. 1 and 2. The non-conductive strip 16 may be polyester, vinyl, asbestos or any other insulation of similar conductive and physical characteristics. The use of such a strip gives the shielding tape much higher tensile strength and greater flexing qualities than a shield consisting solely of a metallic foil. Good results are achieved with a 0.001 inch polyester film. The width of the strip will vary with the diameter of the material being shielded and the type of winding employed, but strips are typically three-fourths inch to 1 inch in width. The metallic foil layer 17 may consist of an aluminum foil of approximately 0.001 inch thickness or similar foils of other metals. The foil layer 17 is bonded to the base strip 16 by an adhesive layer 18. The adhesive may be any conventional bonding agent such as a polyester resin. The drain wires 15 may consist of any suitable conductor such as tinned or bare copper. They may be flat, round, or any other shape which has good flexing and bonding characteristics. In the preferred embodiment of the invention, the drain wires are flat, since this configuration best resists displacement and insulation damage. A shield tape constructed in accor-

dance with the invention may employ one or any number of drain wires **15**. FIG. **4** illustrates another embodiment of the invention in which a number of copper strands will have a diameter of 0.006 to 0.012 inches and be spaced approximately one-sixteenth inch apart.

The drain wires **15** are fixed between the foil **17** and the base **16** in a mutually parallel configuration. To facilitate the overlap winding, the drain wires **15** are located so that they divide the shielding tape approximately into thirds. If a single drain wire is used, it is preferably located one third of the width of the tape from the edge. However, the preferred embodiment employs two drain wires since a single drain wire produces a crown in the shielding tape which makes it difficult to roll the tape into a reel for storage.

FIG. **6** shows a view in cross section of a shielded cable in which the tape shield **14** is wound longitudinally rather than helically. With this type of winding, the width of the shielding tape **14** must be sufficient to completely encircle the conductors. The edges of the tape should overlap slightly to insure a continuous shield.

Although a cable having a pair of central conductors has been disclosed, the tape shield **14** of this invention may also be used to shield single conductors, coaxial cables, groups of conductors in a multi-conductor cable, or the overall cable and all of its component conductors.

There has been disclosed a shielded, flexible electric cable with a drain wire integral to the shielding which eliminated damage to the cable elements by the drain wire. There has further been disclosed a continuous metallic foil shield in a tape form which has excellent shielding characteristics and which may be conveniently applied to a conductor. This invention also provides a readily accessible drain wire, or drain wires, for making an efficient connection to a grounding terminal. Various modifications of the invention will become apparent to those skilled in the art from the foregoing description and the accompanying drawings. Such modifications are intended to fall within the scope of the appended claims.

What is claimed is:

1. A shielded electric cable comprising:

a. A central elongated conductor;

b. Insulation surrounding said conductor;

c. A shield consisting of a laminated tape helically wound around said insulation to form a continuous conductive surface, said tape comprising a flexible non-conductive base strip, a metallic foil adhesively bonded to said base strip, and at least one longitudinal drain wire in continuous electrical contact with said foil interposed between said foil and said base strip; and

d. An insulating outer layer surrounding said shield.

2. The shielded cable of claim **1** in which a plurality of said drain wires are held in electrical contact with said metallic foil by at least one non-conductive holding strip which encloses said drain wires and is adhesively bound to said foil along both sides of each of said drain wires.

3. The shielded cable of claim **1** in which said shield is longitudinally wound around said insulator.

4. The shielded cable of claim **1** in which said base strip consists of a polyester film, said metallic foil consists of aluminum foil, and said drain wire consists of a tinned copper wire.

5. A shielding tape for use in an electric cable comprising a flexible, non-conductive base strip, a metallic foil adhesively bonded to said base strip, and at least one longitudinal drain wire disposed in continuous electrical contact with said foil between said foil and said base strip.

6. The shielding tape of claim **5** in which said drain wires are held in continuous electrical contact with said metallic foil by a plurality of non-conductive holding strips which enclose said drain wires and are adhesively bound to said foil along both sides of each of said drain wires.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,794,750 Dated February 26, 1974

Inventor(s) Alfred Garshick

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 2 reads: "Fig. 4"; should read --Fig. 5--

Column 3, line 4 after "strands" insert --15 are incorporated into the tape. Typically, these strands--

Column 3, line 13 (first occurrence) change "the" to --one--

Signed and sealed this 9th day of July 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.

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