United States Patent

Lasley

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[54] **SHIELDED CABLE**

[72] Inventor: **James A. Lasley**, Richmond, Ind.

[73] Assignee: **Belden Corporation**, Chicago, Ill.

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Related U.S. Application Data

[63] Continuation of Ser. No. 755,252, Aug. 26, 1968, abandoned.

[52] **U.S. Cl.** **174/107**, 174/36, 174/115
[51] **Int. Cl.** **H01b 11/10**
[58] **Field of Search** 174/36, 113, 115, 116, 107

[56] **References Cited**

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Primary Examiner—E. A. Goldberg
Attorney—Anderson, Luedeka, Fitch, Even and Tabin

[57] **ABSTRACT**

A shielded cable is described including a group of sheathed elongated conductors, a surrounding unitary conductive foil shield formed to follow the outer contour of the group of conductors, a plurality of drain wires extending along the outer surface of the shield in the recesses thereof, and an outer sheath of insulating material surrounding the drain wires and the foil shield.

5 Claims, 2 Drawing Figures

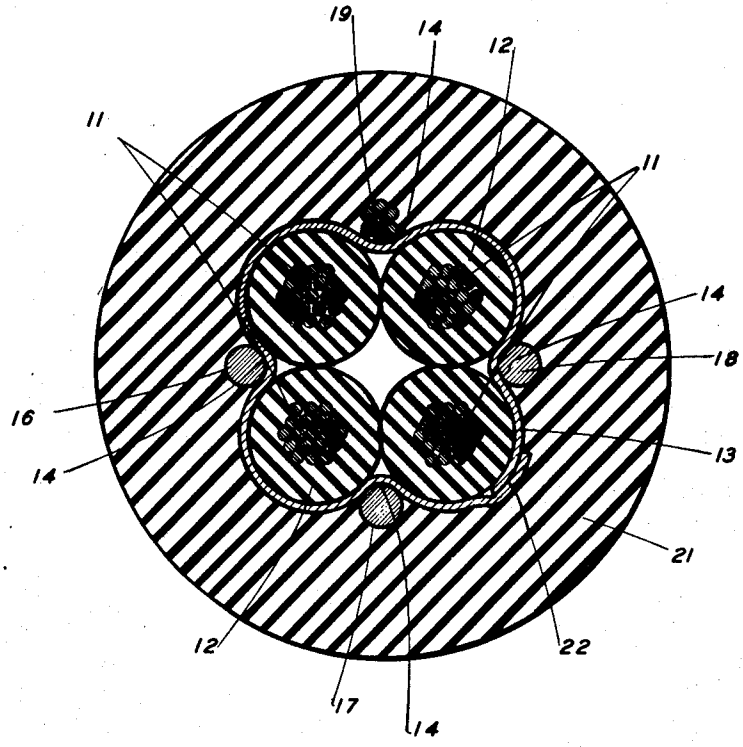


FIG. 1

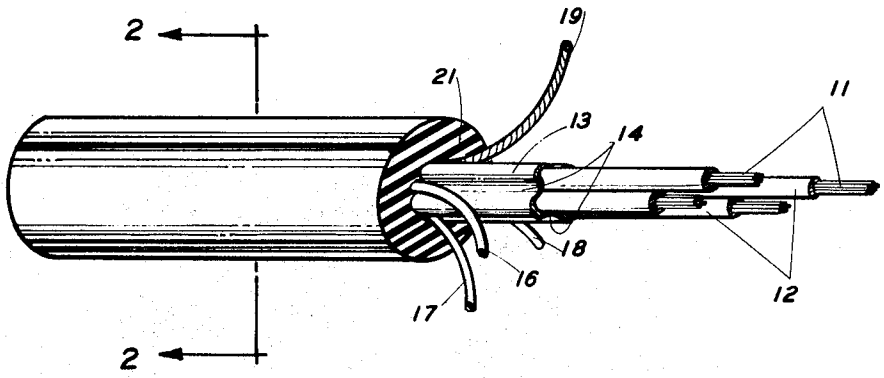
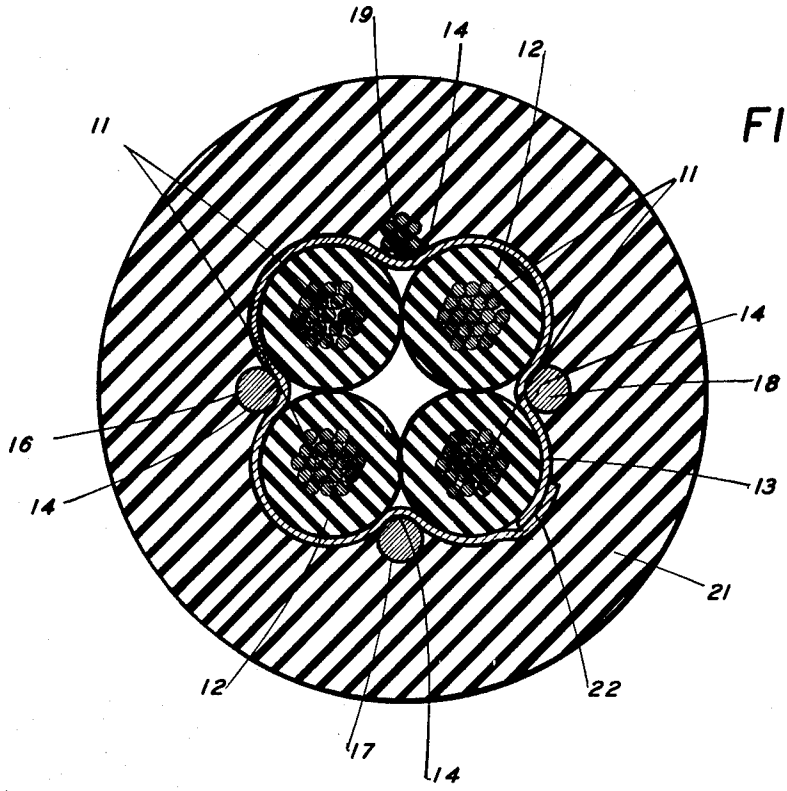


FIG. 2



INVENTOR.
JAMES A. LASLEY
BY
Anderson, Luedeka, Fitch, Even, & Tabin
ATTORNEYS

SHIELDED CABLE

This application is a continuation of Ser. No. 755,252 filed Aug. 26, 1968 now abandoned.

This invention relates to electric cables and, more particularly to a shielded cable of improved electrical and physical properties.

For many applications, it is desirable to utilize a cable in which the conductor is shielded against electrical noise and other forms of interference produced in outside sources. Some types of shielded cable utilize a wire braid surrounding the outer surface of the sheath or sheaths in which the conductor or conductors are enclosed. Ground connection may be made to the wire braid at one or both ends of the cable by unbraiding a portion of the wire braid and making a suitable soldered connection. Shielded cable utilizing wire braid generally exhibits good physical strength and flexibility and symmetrical capacitance. Wire braid shielded cables are, however, unsatisfactory for certain applications in which interference is a major problem. This is because the spaces between the wires in a braided wire shield limit the effectiveness of the shield.

Shielded cable utilizing a flexible foil shield instead of a wire braid shield generally exhibits greater effectiveness in shielding a conductor or conductors from outside interference. To facilitate connection of the shield to ground at one or both ends of the cable, a drain wire is generally placed alongside the shield extending the length thereof. In many circumstances, however, the out-of-round configuration resulting from the use of a single large drain wire is undesirable. Moreover, the use of a large single drain wire extending along the cable parallel with the conductors thereof may result in physical derangement of the physical positioning of the conductors relative to each other thereby producing an undesirable capacitance unbalance, that is, a variation in the capacitance of the conductors relative to each other.

It is an object of this invention to provide a markedly improved shielded cable.

Another object of the invention is to provide a shielded cable with great shielding effectiveness and which is of symmetrical cross section.

A further object of the invention is to provide a foil shielded cable of minimum diameter and maximum tensile strength.

Other objects of the invention will become apparent to those skilled in the art from the following description, taken in connection with the accompanying drawings wherein:

FIG. 1 is a perspective view of a shielded cable constructed in accordance with the invention, the cable being partially sectioned and having parts broken or bent away to illustrate its internal construction; and

FIG. 2 is a sectional view taken along the line 2—2 of FIG. 1.

Very generally, the shielded cable of the invention comprises a plurality of elongated conductors **11**, each having an individual inner sheath **12** of insulation. Each of the inner sheaths are of generally circular cross section and the conductors are disposed in a group immediately adjacent each other in a symmetrical relationship and with their sheaths in contact or uniformly spaced by means of a suitable filler material. A flexible foil shield **13** surrounds the group of conductors and extends along the length thereof. The foil shield is formed to follow substantially the outer contour of the sheaths of the group of conductors and thus has a plurality of elongated recesses **14** distributed symmetrically about its outer surface. A plurality of drain wires **16, 17, 18** and **19** extend along the outer surface of the foil shield in contact therewith. Each of the drain wires lies in one of the recesses. An outer sheath **21** of insulating material surrounds the drain wires and foil shield.

Referring now more particularly to the drawings, the illustrated embodiment of the invention includes four stranded wires or conductors **11**, each surrounded by the sheath **12** of insulation material of any suitable type. The cross section of each sheath is generally circular in outline and the conductors are disposed adjacent each other so that their sheaths are in contact. The axes of the conductors **11** are parallel with each other, and the conductors may be straight or twisted together.

In either case, where four conductors are utilized, the axes are disposed in a generally orthagonal relationship in the cross sectional plane.

Surrounding the group of four conductors is the shield **13** which serves to minimize the coupling of extraneous signals into the conductors. For maximum strength and flex life, the shield **13** is preferably in the form of a flexible tape formed by laminating a thin foil of aluminum to both sides of an insulating tape such as polyethylene terephthalate. The shield tape **13** is wrapped about the group of conductors **11** with the longitudinal axis of the tape generally parallel to the axis of the conductors **11**. As illustrated in FIG. **2**, the marginal edges of the tape **13** are shown overlapping at **22** so that the shield forms a shorted turn about the group of conductors it surrounds. The flexible foil tape **13** may also be formed by laminating the thin foil to only one side of the supporting film. In such an embodiment, the tape would be wrapped about the conductors with the metallic side outermost and the outer marginal edge of the tape would be folded under to form a shorted turn.

The foil shield **13** is continuous, extending substantially the entire length of the conductors, and is formed against the group of conductors **11** to follow substantially the outer contour of the sheaths of the group of conductors. It will therefore be seen that the shield forms the plurality of elongated recesses **14** in the interstices or valleys between the sheaths of the conductors **11**.

In order to prevent any open circuiting of the shield, to strengthen the cable, and to facilitate connection of the shield to ground, the four drain wires **16-19** are provided. Each of the wires is of a diameter to fit conveniently within a corresponding recess **14**, and is disposed against the outer surface of the foil shield throughout substantially the entire length of both the foil shield and the drain wire. In the event that the four conductors **11** are twisted, the drain wires will also be twisted to follow the resulting helical grooves or recesses in the outer surface of the shield. Three of the drain wires **16, 17** and **18** are shown as solid conductors and one drain wire **19** is shown as a stranded conductor. The stranded drain wire **19** can serve as a convenient grounding wire at the end of the cable, if mimimal ground conductivity only is required. Any combination of solid and/or stranded drain wires may be used depending upon the requirements of the performance, flexibility and economics.

The outer sheath **21** of insulating material surrounds the drain wires **16, 17, 18** and **19**, and the foil shield **13**, completely insulating the electrically conductive elements in the cable. Because of the symmetrical arrangement of the drain wires and the conductors and the foil shield, the thickness of the sheath **21** is relatively uniform and the periphery of the cross section thereof may be circular. Moreover, smaller diameter drain wires may be employed than in the case of a large single drain wire and hence the overall diameter of the cable is smaller. This results in less material being employed for the insulating sheath **21**.

The design of the shielded cable of the invention provides a cable which has virtually all the advantages of a wire braid shield while providing the higher shielding effectiveness of a foil shield. In particular, the cable of the invention is symmetrical, smaller in diameter, and does not present fabrication, strength and capacitance unbalance problems frequently encountered in connection with foil shielded construction using a large, single drain wire. Accordingly, the design is less costly and is superior electrically and physically to prior art constructions.

It may therefore be seen that the invention provides an improved shielded cable utilizing a foil shield for highly effective shielding and which is symmetrical and of minimum diameter with maximum tensile strength.

Various modifications of the invention will become apparent to those skilled in the art from the foregoing description and accompanying drawings. Such modifications are intended to fall within the scope of the appended claims.

What is claimed is:

1. An elongated shielded cable having a longitudinally extending axis and a substantially circular cross section taken at right angles to said axis, said cable comprising at least three elongated conductors each having an individual inner sheath of insulation, each of said inner sheaths being of generally circular cross section, said elongated conductors being disposed in a group immediately adjacent each other in a symmetrical relationship about said longitudinal axis, said sheaths of said elongated conductors being in contact and defining a longitudinally extending empty space in said cable at said longitudinally extending axis, a flexible, conductive foil shield surrounding said group of conductors and extending along the length thereof, said conductive shield having its longitudinal edges overlapped in a manner providing a single shorted turn about the enclosed conductors, said conductive shield being formed to follow substantially the outer contour of said sheaths of said group of conductors and thus having a plurality of elongated recesses distributed symmetrically about its outer surface, a plurality of drain wires extending along the outer surface of said conductive shield in contact therewith, the number of drain wires being equal to the number of recesses, each recess having one of said drain wires lying therein and extending therewith, said drain wires being held by said foil shield against inward movement toward said empty space at said longitudinally extending axis to prevent said conductors from separating and to prevent a capacitance unbalance, an outer extruded sheath of insulating material surrounding said drain wires and extending partially into said recesses and about said drain wires and holding said drain wires in contact with said shield, said drain wires substantially filling said recesses and providing a more relatively uniform cross sectional thickness for said shield and a rounded cross section for said cable.

2. A shielded cable in accordance with claim 1 in which said conductive shield comprises an elongated insulating tape having a conductive foil laminated thereto on the outer side thereof with the longitudinally extending edges of the foil overlapped in a manner to provide a single shorted turn about the enclosed conductors.

3. A shielded cable according to claim 1 wherein there are four of said conductors having mutually parallel axes disposed in a generally orthagonal relationship, and wherein there are four drain wires.

4. A shielded cable according to claim 1 wherein said plurality of drain wires includes both stranded drain wires and solid drain wires.

5. An elongated shielded cable having a longitudinally extending axis and a rounded cross section comprising, at least three elongated conductors each having an individual inner sheath of insulation, each of said inner sheaths being of generally circular cross section, said elongated conductors being disposed in a group immediately adjacent each other in a symmetrical relationship and having their sheaths in contact and defining a longitudinally extending empty space in said cable at a longitudinally extending axis for said cable, a flexible shield surrounding said group of conductors and extending along the length thereof, said shield having an elongated conductive foil having its longitudinal edges overlapped in a manner providing a single shorted turn about the enclosed conductors, said shield being formed to follow substantially the outer contour of said sheaths of said group of conductors and thus having a plurality of elongated recesses distributed symmetrically about its outer surface, a plurality of drain wires extending along the outer surface of said shield in contact with said conductive foil thereof, the number of drain wires being equal to the number of recesses and each recess having one of said drain wires lying therein and extending therewith, and an outer extruded sheath of insulating material having an outer cylindrical peripheral surface and surrounding said drain wires and said shield.

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