

[54] **SHIELDED CABLE**

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[73] Assignee: **Anaconda Wire and Cable Company**

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[51] Int. Cl. **H01b 9/02**

[58] Field of Search..... **174/102 R, 102 SC, 105 R, 105 SC,**

174/106 R, 106 SC, 115, 113 R, 120 SC

[56]

References Cited

UNITED STATES PATENTS

3,474,189	10/1969	Plate et al.....	174/115
2,258,687	10/1941	Peterson.....	174/115
3,571,613	3/1971	Plate et al.....	174/115

3,355,544	11/1967	Costley et al.....	174/106 R
3,351,706	11/1967	Gnerre et al.....	174/105 R
2,446,387	8/1948	Peterson.....	174/105 SC
1,956,639	5/1934	Dana et al.....	174/106 SC
2,337,556	12/1943	Hosking.....	174/106 SC
2,140,270	12/1938	Potter.....	174/115 X

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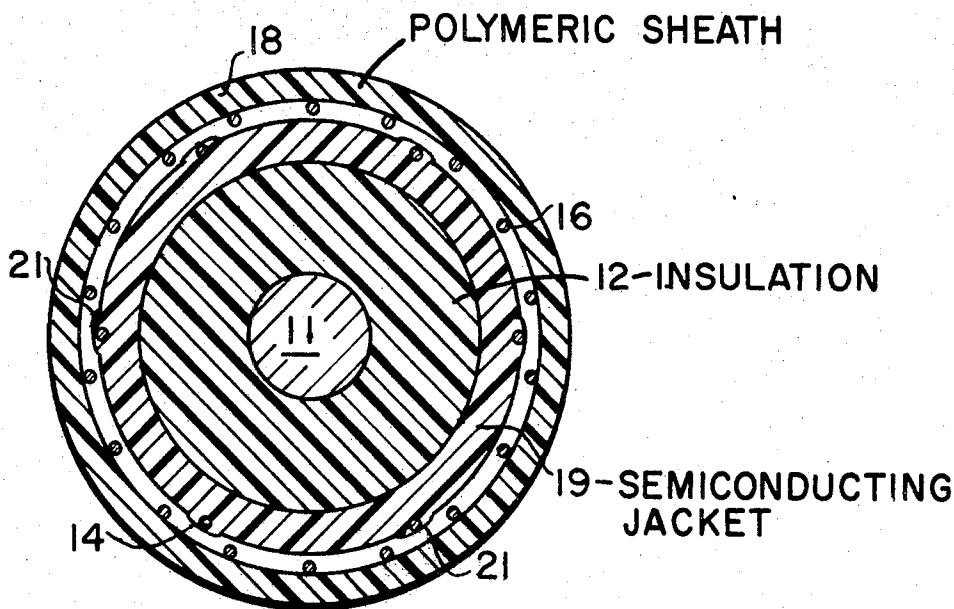
Attorney—**Victor F. Volk**

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ABSTRACT

In an electric power cable a neutral conductor comprising a plurality of separated wires is applied helically over an electrically conducting cable jacket in which longitudinal wires are embedded. The longitudinal wires serve to distribute any heavy fault currents among all the overlaid helical wires.

8 Claims, 2 Drawing Figures



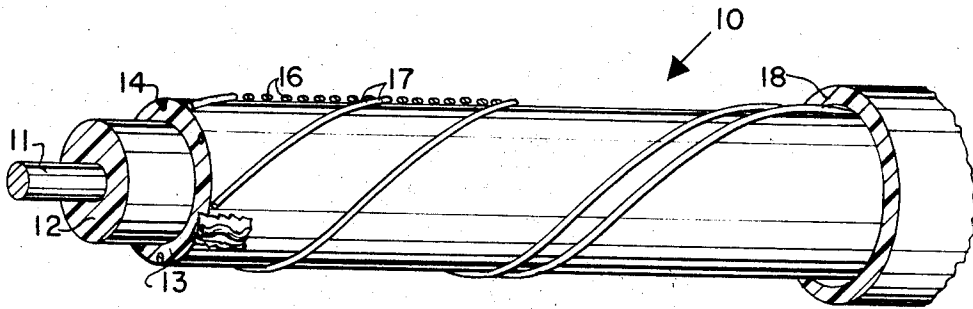


Fig. 1

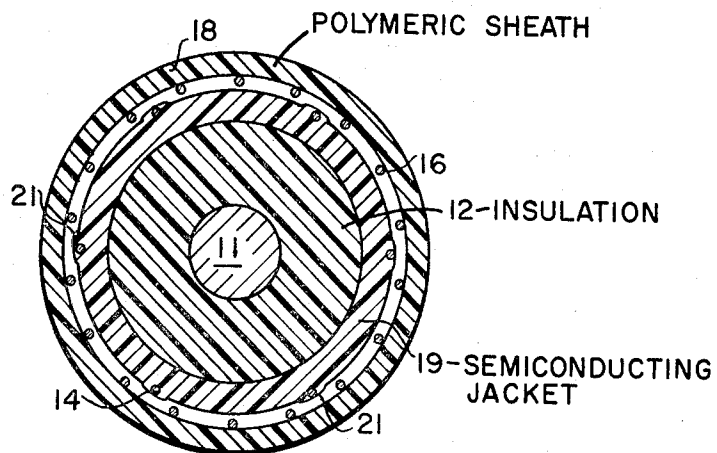


Fig. 2

INVENTOR.

W. J. PLATE

BY

V. F. Volk

HIS AGENT

SHIELDED CABLE

BACKGROUND OF THE INVENTION

In modern electrical distribution systems it is important that the shielding on primary distribution cables be capable of carrying all the current that is generated during fault conditions. The shielding system must keep within the temperature rating of the cable and, to assure proper relaying during a fault and during subsequent breaker reclosures, it must not burn off or vaporize. In many systems all that is required is a normal 3-mil copper tape or equivalent shield and a bare neutral conductor. However, the closer the feeder is located to the substation breaker, the higher the fault current requirements, and there are cases where the shield must be equivalent to a No. 2 AWG (American Wire Gage) copper conductor. It is known to form a neutral conductor or shield by winding a plurality of wires in parallel over a cable jacket. A typical example of a helical shield equivalent to a No. 2 AWG copper wire would be 26 No. 16 AWG parallel helical wires. A serious defect in such known shields results from the likelihood that the fault current will be distributed among only a few of the helical wires with a resulting burn-off and relaying malfunction. It has been suggested to wrap a copper tape over the wires to connect them to each other. This expedient would, however, be expensive in itself and the fragility of the tape might necessitate the additional expense of a protective sheath over the shielding. It has also been suggested to apply half the shield wires with a left-hand lay and half with a right-hand lay, so that all the wires are interconnected, electrically. With this construction, however, the outer wires slip on the inner helix and do not retain their even separation. They may even bunch up and increase the cable diameter so that an assembly requires more than its allotted share of conduit space.

SUMMARY

I have invented an electric power cable comprising a power-current carrying conductor, a layer of electrical insulation surrounding the conductor, a semiconducting polymeric jacket surrounding the insulation, a first plurality of circumferentially spaced, longitudinal wires embedded in the jacket, preferably with their outside surfaces tangent to the outer circumference of the jacket, and a second, greater plurality of wires wound helically directly over the jacket. The helical wires are separated from each other but the longitudinal wires interconnect them during a fault. The embedded wires may advantageously be undulatory as disclosed in U.S. Pat. No. 3,474,189 and/or the cable may have longitudinal bosses as disclosed in U.S. Pat. No. 3,571,613.

BRIEF DESCRIPTION OF THE APPENDED DRAWING

FIG. 1 shows a pictorial view of a cable of my invention.

FIG. 2 shows a section of a different embodiment of the cable of my invention.

The cable of FIG. 1, indicated generally by the numeral 10 has a conductor 11 which may be stranded and may include an outside layer of electrically conducting polymeric strand shielding, not separately shown. The conductor 11 is surrounded by a layer 12 of

insulation such as polyethylene, ethylene-propylene copolymer, or other dielectric extrudable material of which a number of suitable compositions are known. In intimate contact with the layer 12, I have extruded a jacket 13 of semiconducting polymeric material such as, but not limited to the material disclosed in U.S. Pat. Nos. 3,474,189 and 3,571,613. Six drain wires 14 are embedded in the jacket 13 with their outer surfaces tangent to the surface of the jacket layer. The drain wires 14 are not helically wrapped around the cable, but extend longitudinally in parallel lines that are equally spaced around the cable circumference. The number of the drain wires 14 will depend on the cable diameter, a larger number of wires being used for the larger cables. I prefer, however, that there should be no fewer than three nor more than 12 embedded longitudinal drain wires to obtain the maximum advantage from the present invention. Around the jacket 13 I have helically wound 18 shield wires 16. These are evenly spaced and separated from each other by gaps 17, with the result that the wires 16 have a very long lay. A long lay is an advantage in helical shield wires because of the lower current path and consequently reduced resistance. The entire cable 10 is covered with an extruded polyethylene sheath 18 but this sheath will generally not be required where copper is used for the wires 16. Other materials, such, for two examples, polyvinyl chloride and neoprene are suitable for the sheath 18. FIG. 2 shows a section of a cable similar to that of FIG. 1 except that, instead of the smooth jacket 13 I have extruded a bossed jacket 19 with six radial bosses 21, containing the drain wires 14.

A detailed construction of an underground urban distribution (URD) cable made to my invention is described in the example.

EXAMPLE

conductor: 100 mcm 61/wire aluminum, compacted strand shield: extruded semiconducting polymer insulation: cross-linked polyethylene, 0.175 inch wall, diameter 1.46 inch

jacket: semiconducting chlorinated polyethylene 0.100 inch wall, diameter 1.67 inch

drain wires: 6 No. 15 AWG solid bare soft copper, corrugated, embedded in jacket

neutral conductor shield wires: 18 No. 16 AWG solid bare copper

separator over shield: polyester tape

sheath: high-molecular-weight polyethylene 0.080 inch wall diameter 1.95 inch

I have invented a new and useful electric cable of which the foregoing description has been exemplary rather than definitive and for which I desire an award of Letters Patent as defined in the appended claims.

I claim:

1. An electric power cable comprising:

A. a power-current carrying metallic conductor;

B. a layer of electrical insulation surrounding said conductor;

C. a semiconducting polymeric jacket surrounding said insulation;

D. a first plurality of circumferentially spaced, longitudinal wires embedded in said jacket; and

E. a second plurality, exceeding said first plurality, of wires wound helically directly over said jacket,

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said helically wound wires being separated from each other said longitudinal wires electrically interconnecting said helically wound wires during faults.

2. The cable of claim 1 wherein said embedded wires are undulatory.

3. The cable of claim 1 comprising longitudinal bosses in said jacket.

4. The cable of claim 1 wherein the outside surfaces of said longitudinal wires are substantially tangent to the outer circumference of said jacket.

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5. The cable of claim 2 wherein the outside surfaces of said longitudinal wires are substantially tangent to the outer circumference of said jacket.

6. The cable of claim 1 comprising an overall polymeric sheath.

7. The cable of claim 2 comprising an overall polymeric sheath.

8. The cable of claim 3 comprising an overall polymeric sheath.

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CERTIFICATE OF CORRECTION

Patent No. 3,707,595 Dated December 26, 1972
Inventor(s) Walter J. Plate

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

Column 2, line 64 after "spaced" and before the comma
insert -- from each other --
line 67 before "second" insert
-- neutral conductor comprising a --

Signed and sealed this 29th day of May 1973.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

UNITED STATES PATENT OFFICE
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