

- [54] **SHIELDED POWER CABLE**
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- [52] U.S. Cl. 174/115, 174/105 SC, 174/120 SC
[51] Int. Cl. H01b 9/02
[58] Field of Search 174/115, 113 R, 113 C,
174/108, 107, 102 R, 102 SC, 105 SC, 105
R, 106 SC, 126 R, 128, 120 SC

[56] **References Cited**

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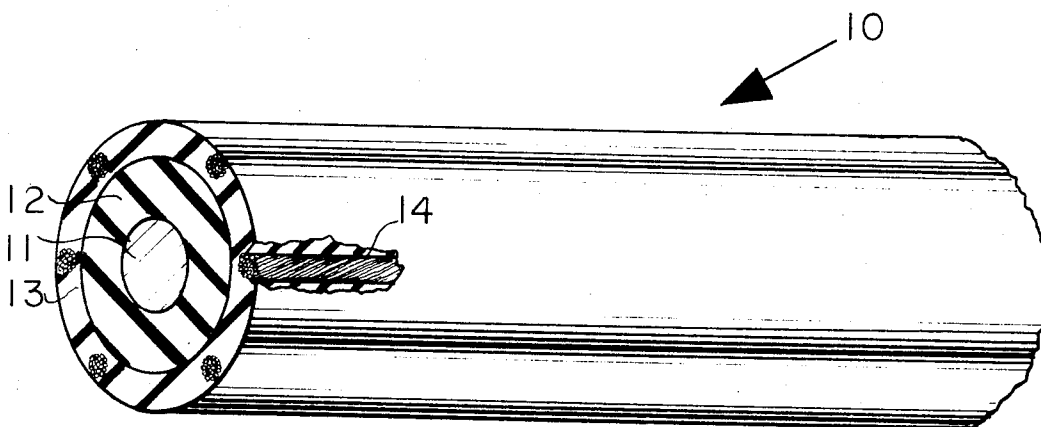
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Assistant Examiner—A. T. Grimley
Attorney—Victor F. Volk

[57] **ABSTRACT**

Electric power cables with semiconducting jackets have stranded or bunched drain conductors embedded in the jackets, in line with the cable axis.

6 Claims, 4 Drawing Figures



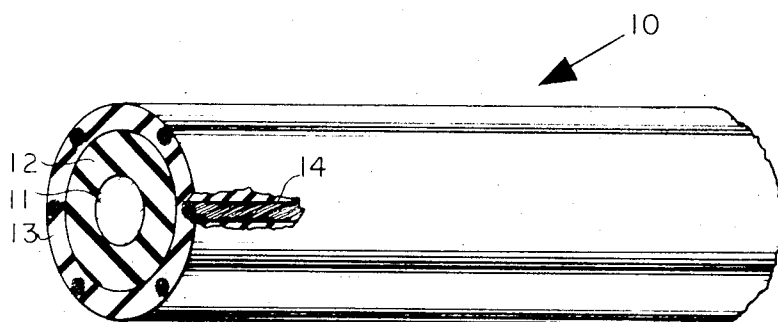


Fig. 1

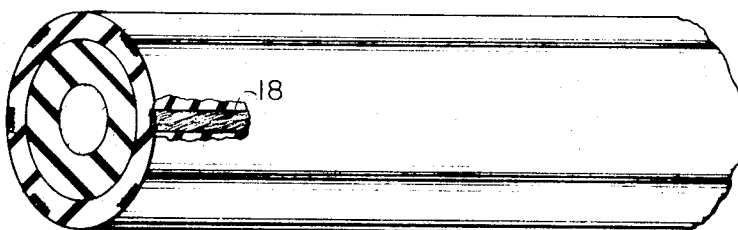


Fig. 2

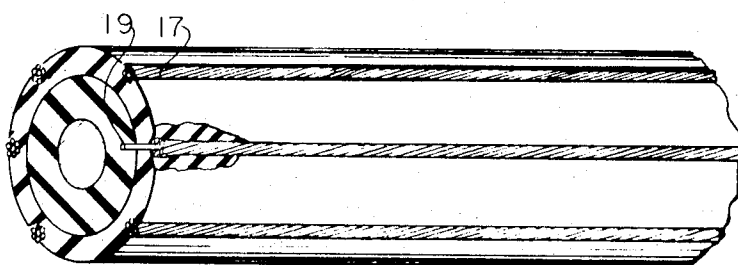


Fig. 3

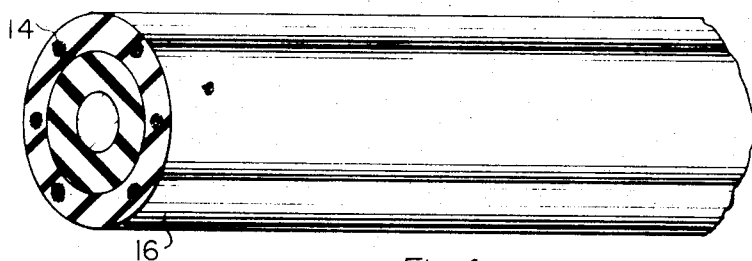


Fig. 4

SHIELDED POWER CABLE

BACKGROUND OF THE INVENTION

In Plate et al. U.S. Pat. No. 3,474,189 issued Oct. 21, 1969 an electric power cable is described having a thick semiconducting polymeric jacket applied directly over the cable insulation and undulatory drain wires embedded in the jacket. These wires are not wrapped helically around the cable but lie on axes parallel to, i.e. in line with, the cable axis. The undulations increase the cable flexibility, since they prevent the wires in the outside arc of a bend in the cable from stretching or breaking. They do require special equipment, however, such, for example, as that described in Menasoff patent 3531962.

SUMMARY

I have now found that a sufficiently flexible cable can be made with embedded drain wires that have been manufactured on conventional equipment such as stranders or, preferably, bunchers. Thus a cable of my invention comprises a conductor, a wall of insulation surrounding the conductor, a thick jacket of semiconducting polymeric material directly surrounding the wall of insulation and a plurality of drain conductors embedded in the jacket substantially in line with the cable axis. The conductors each comprises a plurality of wires and each of these wires is helically wound around at least one other wire within the same plurality forming that drain conductor. The drain conductors are preferably copper or aluminum or alloys of copper or aluminum and preferably comprise bunched strands in which case the diameters of the wires are preferably 0.005-0.010 inch for copper and 0.007-0.012 inch for aluminum. Advantageously the bunched strands have been flattened to an oval section to cover a greater area of the cable surface, and reduce the thickness of jacket necessary to contain them.

BRIEF DESCRIPTION OF THE DRAWING:

FIG. 1 shows a pictorial view, partially cut away, of one embodiment of a cable of my invention.

FIG. 2 shows a pictorial view, partially cut away, of another embodiment of the cable of my invention.

FIG. 3 shows a pictorial view, partially cut away, of still another embodiment of the cable of my invention.

FIG. 4 shows a pictorial view of still another embodiment of the cable of my invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

Referring to the Figures, my cable, indicated generally in FIG. 1 by the numeral 10, comprises a conductor 11, a layer of insulation 12 and a semiconducting jacket 13 none of which is, of itself, novel and which are adequately described in the aforementioned U.S. Pat. No. 3,474,189, the disclosures of which, where relevant, are included in the present description. A novel feature of the present invention resides, however, in a drain wire 14 comprising bunched copper strand. "Bunched strand" is a term well established in the cable arts and corresponds to the term "bunched-stranded conductor" defined in ASTM Designation B 354-70a. Bunched strands are manufactured by machines known as "bunchers" or "bunch-stranders"

for making an electrical conductor from a relatively large number of fine wires by twisting the wires together without a symmetric geometrical pattern. The American Standard for Testing Materials (ASTM) has a designation B 174-75 for Bunch-Stranded Copper Conductors for Electrical Conductors which tabulates the following construction for bunch-stranded conductors

TABLE 1

Size of Conductor Awg No.	Minimum number of wires in conductor Size of wires, Awg						
	No. 28	No. 30	No. 32	No. 34	No. 36	No. 38	No. 40
12	41	65	104				
14	26	41	65	104			
16	16	26	41	65	104	165	
18	10	16	26	41	65	104	165
20	7	10	16	26	41	65	104

A feature of bunched strands that adds to their utility for my invention resides in the absence of any straight central wire like those that are found in concentric stranded conductors. Such a central strand would be stretched, possibly to the breaking point, upon bending the cable 10. The fact that bunchers are available in most cable plants or can be purchased from commercial sources without recourse to special designing and fabricating provides an advantage to the use of bunched strand in my present invention. To manufacture my cable 10 the bunched strands 14 are paid through the extrusion die during the extrusion of the jacket 13 and the extrusion head can be adjusted or designed to embed the conductor 14 tangent to the outer surface of the jacket as in FIG. 1 or well below the surface as illustrated by a cable 16 in FIG. 4. The bunched strands may also be embedded so as to project from the surface and expose a portion of the metal as exemplified for an elastic cored strand 17, to be further described below, in FIG. 3. Because of its higher conductivity and resistance to moisture-induced corrosion I prefer copper or copper alloys for the conductors 14 and 17, but where corrosion presents no problem aluminum or aluminum alloys of high electrical conductivity may also be used.

FIG. 2 illustrates an embodiment of my invention wherein a bunched drain conductor 18 has been flattened, by passage through rolls, to an oval shape, before being embedded in the cable jacket. This flattening has the advantage of affording a greater area of metallic shielding to the cable surface and a greater area of contact between the metal of the conductors and the semiconducting jacket composition. It also allows a reduction in the thickness of jacket necessary to embed the drain conductors. Reduction in the radial dimension of bunched conductors to as little as 30 percent of their original diameter is feasible for copper conductors and as little as 50 percent for aluminum conductors although, in the case of aluminum alloys, that do not become embrittled during the operation of rolling, somewhat greater reductions are possible.

If a group of parallel wires are wrapped as a unit around a core that is later withdrawn from the wrapped strand, each of the wires will have been wrapped around all of the others, unless, during the wrapping operation the group of wires was back-twisted around its own axis as is done during planetary stranding. This

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wrapping of the "parallel" wires around themselves is readily demonstrated by the impossibility of lifting one of the wires from the strand after the core has been withdrawn. In a bunched strand each of the wires wraps around at least some of the remaining wires in the bunch and so acquires an additional length that adds flexibility. In the embodiment of FIG. 3 the wires are not bunch stranded but are evenly wound around a flexible core 19 which may preferably comprise an extruded filament of the same semiconducting stock as the jacket 13 but may comprise other filaments such as polycarbonate and polyimide that will not melt or disintegrate at the extrusion temperatures of a particular jacket stock.

The foregoing description has been exemplary rather than definitive of my invention 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 conductor,
 - B. a wall of insulation surrounding said conductor,
 - C. a thick jacket of semiconducting polymeric

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material directly surrounding said wall of insulation, and

- D. a plurality of bunch stranded drain conductors embedded in said jacket substantially in line with the axis of said cable,
- E. said drain conductors each comprising a plurality of wires, each of the wires within one of said plurality of wires being helically wound around at least one other wire within said plurality of wires.
2. The cable of claim 1 wherein said wires are selected from the group consisting of copper and copper alloys.
3. The cable of claim 1 wherein said wires are selected from the group consisting of aluminum and aluminum alloys.
4. The cable of claim 1 wherein said bunch-stranded drain conductors are flattened to an oval shape
5. The cable of claim 2 wherein said bunch-stranded drain conductors are flattened to an oval shape.
6. The cable of claim 3 wherein said bunch-stranded drain conductors are flattened to an oval shape.

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