United States Patent [19]

Parker

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[54] **TAMPER PROOF ELECTRICAL CABLES**

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[*] Notice: The portion of the term of this patent subsequent to Oct. 10, 1989, has been disclaimed.

[22] Filed: **July 15, 1971**

[21] Appl. No.: **163,060**

Related U.S. Application Data

[63] Continuation of Ser. No. 866,817, Oct. 16, 1969, abandoned.

[30] **Foreign Application Priority Data**

Oct. 18, 1968 Great Britain..... 49575/68

[52] **U.S. Cl.** ..... **174/115,** 174/118, 340/253 B, 340/276

[51] **Int. Cl.** **H01b 7/32**

[58] **Field of Search**.... 340/409, 253 R, 253 B, 276; 174/115, 118, 103, 107, 102 P

[56] **References Cited**

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Primary Examiner—E. A. Goldberg
Attorney, Agent, or Firm—Webb, Burden, Robinson & Webb

[57] **ABSTRACT**

An electric power or communication cable incorporates a mineral insulated cable of a cross-section that is small in comparison with the overall cross-section of the cable, a conductor or conductors of the mineral insulated cable being adapted to carry a signal other than the normal power or signalling load of the power or communication cable. Preferably the or each mineral insulated cable is so located in the cable that it is not easily recognized as an alarm circuit by a thief. In an electric power cable having armouring or a concentric screen or neutral conductor comprising wires applied as a continuous helical lapping or with periodically reversing lay one or more of the wires may be replaced by a mineral insulated cable.

12 Claims, 5 Drawing Figures

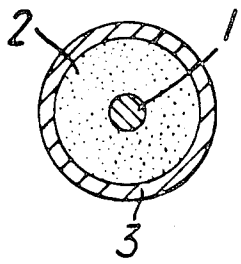


Fig. 1.

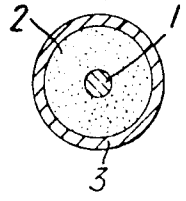


Fig. 2.

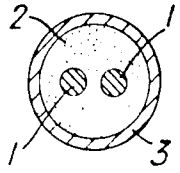


Fig. 3.

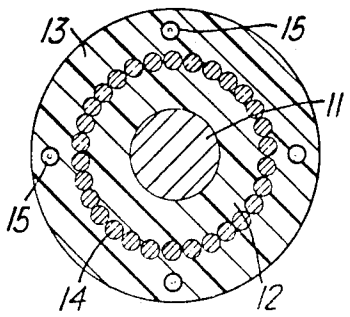


Fig. 5.

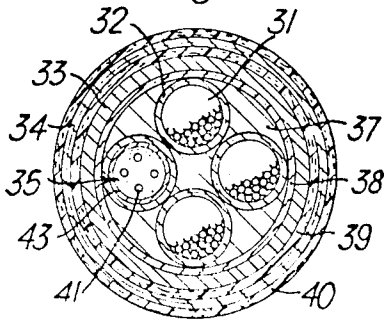
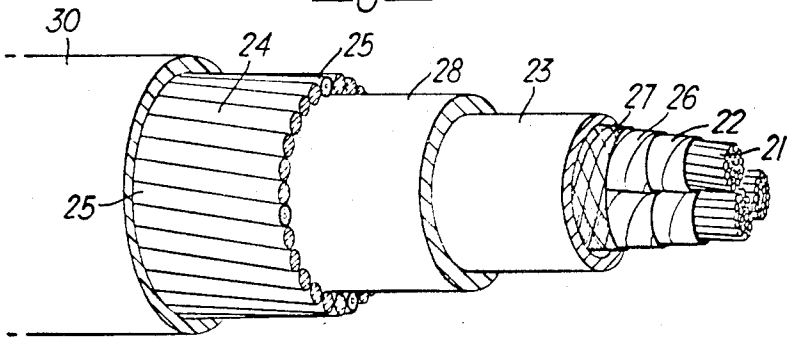


Fig. 4.



TAMPER PROOF ELECTRICAL CABLES

This application is a continuation of United States Patent Application Ser. No. 866,817 filed Oct. 16, 1969 now abandoned.

This invention relates to electric power and communication cables incorporating an auxiliary signalling circuit adapted to operate an alarm when the cable is cut or severely damaged.

The principal object of the invention is to provide a cable incorporating one or more conductors which are suitable for connection in an alarm circuit and which are not easily accessible to a thief who wishes to put the alarm circuit out of action to enable him to steal a length of the cable.

In accordance with the present invention an electric power or communication cable incorporates a mineral insulated cable of a cross-section that is small in comparison with the overall cross-section of the cable, a conductor or conductors of the mineral insulated cable being adapted to carry a signal other than the normal power or signalling load of the power or communication cable. The term 'mineral insulated cable' means a cable comprising a metal sheath enclosing one or more conductors which is or are separated from the sheath (and from each other when there is more than one conductor) by a compacted inorganic powder, usually magnesium oxide.

Although the mineral insulated cable can be incorporated in any part of the cable in a position where it does not interfere with the normal functioning of the cable, for example it may be embedded in a plastics sheath of the cable, it is preferably incorporated in such a way that it is not easily recognised as an alarm circuit by a thief. In power distribution cables the mineral insulated cable may for example replace one or more of the armouring wires or one or more of the wires of a concentric screen or neutral conductor, whether applied as a continuous helical lapping or with periodically reversing lay. In this case the sheath of the mineral insulated cable is preferably of the same external diameter as the wire or wires that it replaces and is preferably made of a material or coated with a material that is the same as or resembles that of the surface of the wire or wires that it replaces.

The mechanical strength (both tensile and compression) of the mineral insulated cable is preferably such that it can be incorporated in the cable by means of the normal machinery used in manufacturing the cable. It will usually not be necessary to make it of especially low tensile strength such that it is easily broken by a thief, since heavy cables of the kind containing sufficient metal to attract a thief will normally have be sawn through by the thief.

Although as indicated above the principal object of the invention is to protect an electric cable against theft, it will be appreciated that the alarm circuit to which the mineral insulated cable is connected will operate whenever the electric cable is severely damaged, either accidentally or intentionally. For this reason it may in some circumstances be advantageous to incorporate in the electric cable more than one mineral insulated cable and to distribute these cables at spaced intervals around the periphery of the electric cable, for example four mineral insulated cables can be used to replace four armour wires spaced at intervals of 90°.

The invention includes a cable installation incorporating any form of cable described above with at least one conductor of the or each mineral insulated cable connected in an alarm circuit.

Three forms of electric cable in accordance with the invention will now be described, by way of example, with reference to the accompanying drawing, in which:

FIGS. 1 and 2 illustrate cross-sectional views of typical forms of mineral insulated cable that can be incorporated in electric power or communication cables,

FIG. 3 is a cross-sectional view of an electric service cable in accordance with the invention generally used for connecting a consumer, e.g. a house or factory, to an electric power distribution cable,

FIG. 4 is a sectional side view of a cut-back end of a three-core electric power distribution cable in accordance with the invention, and

FIG. 5 is a cross-sectional view of a four-core electric power cable in accordance with the invention.

The mineral insulated cable shown in FIG. 1 is a conventional single core cable comprising a single conductor 1 separated from a metal sheath 3 by compacted magnesium oxide 2. In the conventional twin core cable shown in FIG. 2 two conductors 1 are separated from each other and from the metal sheath 3 by compacted magnesium oxide 2.

The consumer service cable illustrated in FIG. 3 comprises a single solid aluminium conductor 11, a layer of plastics material 12 constituting the conductor dielectric, a concentric layer 14 of round metal wires lapped helically about the conductor dielectric to form the neutral conductor and, enclosing the assembly, a sheath 13 of plastics material. Embedded in the sheath 13 and spaced at intervals of 90° around the periphery of the cable are four mineral insulated cables 15 of the type shown in FIG. 1 whose conductors 1 can be connected in an appropriate alarm circuit when the service cable is installed. The mineral insulated cables 15 may each extend substantially parallel to the axis of the cable or each may follow a helical path about the cable.

The distribution cable shown in FIG. 4 is a three-core paper-insulated lead sheathed single-wire armoured 11kV cable comprising three stranded conductors 21 each of which has insulation 22 of lapped impregnated paper and a dielectric screen 26. The three insulated conductors are surrounded by several layers of wire woven fabric tape 27 and are enclosed in a lead sheath 23. A single layer of steel armouring wires 24 is lapped helically on conventional armour bedding 28 on the outside of the lead sheath 23 and the cable armouring is protected by conventional hessian serving 30. At each of four positions spaced at intervals of 90° around the cable a mineral insulated cable 25 of the type shown in FIG. 1 whose conductor can be connected in an appropriate alarm circuit replaces the steel armouring wire that would otherwise be located at that position. The sheath of each mineral insulated cable 25 has an external diameter equal to that of each of the armouring wires and is made of a material such as cupronickel or mild steel that causes the sheath to resemble the surfaces of the other armouring wires thereby ensuring that the mineral insulated cable is not easily recognised by a thief as the cable of an alarm circuit.

The further form of multi-core power cable shown in FIG. 5 is a four core cable suitable for use in a 1.1 kV

three phase four wire system. The cable is of conventional construction except that one stranded conductor of the cable is replaced by a mineral insulated cable having four conductors. The cable comprises three stranded conductors **31** and a mineral insulated cable **35** each enclosed in a separate body **32** of impregnated paper insulation, the cores so formed being laid up together with fillers **37** and surrounded by a belt **38** of impregnated paper. A lead sheath **33** enclosed the laid-up cores and carries on its outer surface bedding **39** on which steel tape armour **34** is applied. Serving **40** of conventional form is applied to the outer surface of the armour. The metal sheath **43** of the mineral insulated cable **35** is adapted to serve as the neutral or earth continuity conductor of the cable and one or more of the four conductors **41** of the mineral insulated cable can be connected to a suitable alarm circuit.

It will be appreciated that although the invention is primarily concerned with the provision of a cable incorporating one or more mineral insulated cables whose conductor or conductors are suitable for connection in an alarm circuit and are not easily accessible to a thief who wishes to put the alarm circuit out of action, in the case where a mineral insulated cable has a plurality of conductors, e.g. four, some or all of these conductors could be employed in a telecommunication circuit or for transmission of other types of electric signal.

An advantage of the cable of the present invention is that, even if the mineral insulated cable is recognised by a thief, it is not easy for him to gain access to its conductor or conductors in such a way as to be able to connect them separately to a source of potential, such as a battery, so as to prevent operation of the alarm.

I claim:

1. An electric cable comprising at least one core for carrying the normal load of the electric cable and, as an element of the cable, a mineral insulated cable having at least one conductor and a metal sheath, which mineral insulated cable is of a cross-section that is small in comparison with the overall cross-section of the electric cable and has at least one conductor adapted to carry a signal other than the normal load of the electric cable.

2. An electric cable comprising at least one core for carrying the normal load of the electric cable and, as an element of the cable, a mineral insulated cable having at least one conductor and a metal sheath, which mineral insulated cable is of cross-section that is small in comparison with the overall cross-section of the electric cable and has at least one conductor adapted to carry a signal other than the normal load of the electric cable, the mineral insulated cable being so located in the electric cable that it is not easily recognized as an alarm circuit by a thief.

3. An electric power cable comprising at least one core and, helically applied about the core, a layer of wires, wherein a mineral insulated cable having at least one conductor and a metal sheath constitutes an element of the layer of wires, the mineral insulated cable being of a cross-section that is small in comparison with the overall cross-section of the power cable and at least one conductor adapted to carry a signal other than the normal load of the power cable.

4. An electric power cable as claimed in claim **3**, in which the sheath of the mineral insulated cable is of the same external diameter as a wire of the layer of wires.

5. An electric power cable as claimed in claim **4**, in which at least the outer surface of the sheath of the mineral insulated cable is of a material that is the same as that of the surface of each wire.

6. An electric power cable as claimed in claim **4**, in which at least the outer surface of the sheath of the mineral insulated cable is of a material that resembles that of the surface of each wire.

7. An electric power cable as claimed in claim **3**, in which the layer of wires constitutes the armouring of the power cable.

8. An electric power cable as claimed in claim **3**, in which the layer of wires constitutes a neutral conductor of the power cable.

9. An electric power cable as claimed in claim **3**, in which the layer of wires constitutes a concentric screen of the power cable.

10. A multi-core electric power cable having at least two cores for carrying the normal load of the power cable and as one core of the power cable a mineral insulated cable which has a metal sheath and at least one conductor adapted to carry a signal other than the normal load of the power cable, the core constituted by the mineral insulated cable being of substantially the same overall diameter as each of the cores carrying the normal load of the power cable.

11. A multi-core electric power cable as claimed in claim **10**, in which the sheath of the mineral insulated cable constitutes the neutral conductor of the power cable.

12. A multi-core electric power cable as claimed in claim **10**, in which the sheath of the mineral insulated cable constitutes the earth continuity conductor of the power cable.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,789,130 Dated January 29, 1974

Inventor(s) Herbert William Mansfield Parker

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

The inventor's address reads --Zebbug; Malta, England--.
It should read --Zebbug, Malta--.

Signed and sealed this 11th day of June 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

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