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FLAME-RESISTANT ELECTRICAL LINE

The invention relates to a flame-resistant electrical line comprising at least one electrical conductor, an insulation surrounding the latter, and a glass-fabric band which is wound round the insulated conductor, with overlapping edges, and which is provided on one side with a metal layer (cf. German Patent Specification 3,044,871).

The electrical "lines" referred to herein are lines along which telecommunication signals can be transmitted with low loss and free of interference. They thus comprise high-frequency (HF) lines and low-frequency (LF) lines. HF lines are used, for example, in radio-link and antenna systems, and in VHF, broadcasting and television receiving systems. LF lines are required, for example, for electroacoustics and audiometry. With only one conductor, they are used, for example, as connecting cords for crystal microphones, magnetic sound-recording heads and dictating machines.

In the first place, in deciding upon the construction of the lines and the materials used for them, one would tend to take into account only the electrical properties of these materials, and to seek to obtain the best possible transmission properties. However, for many uses, e.g. installation in buildings or switchgear, it is also necessary to ensure that, in the event of a fire, the lines themselves do not burn, and can continue to perform their function even at very high temperatures, at least for a certain period of time. In this connection, therefore, the word "flame-resistant"

is used to refer to the properties which are to be desired in an electrical line in the event of a fire, including a minimal smoke emission, incombustibility, and freedom from halogens.

German Offenlegungsschrift 2,800,688 describes an electrical cable with conductors, the insulation of which consists of a mica band and a layer of rubber applied around it. An aluminium-and-plastics laminate is wound round the insulated conductors (wires) of this cable. A polyester band is wound round the cable core consisting of the wires, and a layer of a thermoplastic elastomer filled with aluminium hydroxide is applied around this polyester band. A glass-fibre mat, on top of which is a braided metal cladding, is wound on around this layer. A layer of chlorosulphonated polyethylene is applied as an outer protective sheath. The effort and expense required in producing such a cable are considerable. This applies both to the conductors, whose insulation comprises a mica band, and to the cable as a whole, whose sheath surrounding the cable core consists of five different layers which cannot be applied in a single operation. It is therefore scarcely possible for the use of such cable to be economical.

The line according to the German Patent Specification 3,044,871 mentioned above is of substantially simpler construction. Here, only an aluminium-coated polyester band and a plastics outer protective sheath are provided around the core formed by a plurality of insulated conductors. A polyvinyl chloride composition with a high filler content is used for insulating the conductors. This is intended to ensure that the insulation still remains stable even at very high temperatures exceeding 1000°C, so

that short-circuits are prevented. Because of its choice of insulating material, however, this known line cannot be used for purposes where there are stringent requirements as to transmission properties; moreover, if fire reaches the polyvinyl chloride for any reason, it starts to burn, thus releasing highly toxic and dangerous chlorine gas.

It is an object of the present invention to provide a flame-resistant line which is of a simple construction but nevertheless meets stringent requirements as to its transmission properties, and which is non-combustible even at temperatures exceeding 1000°C.

According to the present invention, there is provided a flame-resistant electrical line comprising at least one electrical conductor, an insulation surrounding the latter, and a glass-fabric band which is wound round the insulated conductor, with overlapping edges, and which is provided on one side with a metal layer, wherein the insulation of the at least one conductor is composed of a plastics material comprising a halogen-free polymer, a metal screening is laid around the insulation, the said band, with the metal layer on the outside, is wound around the screening, the width of the overlap of the said overlapping edges is between 7% and 35% of the width of the said band, and a sheath composed of an insulating material is applied around the band.

A plastics material comprising a halogen-free polymer, e.g. polyethylene, which guarantees the favourable transmission properties of the line, is used to insulate the conductor. This material, although combustible in itself, is adopted for the sake of good transmission properties. However, the said band wound on with overlap, consisting of

metal-coated glass fabric, protects it so effectively that it cannot burn. The band is wound on to the insulation or screening in such a way that the metal layer is on the outside. It therefore acts towards a flame in the same way as a closed metal tube, except in that the overlap is made small enough to ensure that this "tube" has sufficient gaps to allow the gases generated within it under great heat to escape. This prevents the wrapping provided by the band from bursting open. The screening necessary for the intended use of the line is likewise surrounded by the band, and is therefore also protected by it. The sheathing applied as an outer layer serves to provide mechanical protection for the line as a whole, but particularly for the band.

Two embodiments of the invention are shown in the accompanying diagrammatic drawings, in which:

Figure 1 is a side view of an electrical line according to the invention, with its inner layers removed stepwise,

Figure 2 is a section through Figure 1 on the line II - II, on an enlarged scale,

Figure 3 is a side view of a line modified in comparison with that of Figure 1, and

Figure 4 is a section through Figure 3 on the line IV - IV, on an enlarged scale.

Figure 1 shows an HF line with a conductor 1, an insulation 2 and a screening 3. The conductor 1 can be a bunched conductor, with a plurality of combined individual wires, or a solid conductor. It is preferably of copper. The screening 3 laid around the insulation 2, which in the case of HF lines is also to be regarded as the "outer conductor", can consist of braided or stranded individual wires, in the case of Figure 1. However, in the case of

Figure 3, it consists instead of a metal band wound round the insulation 2, or folded longitudinally around it. The screening 3 is also preferably of copper.

A plastics material comprising a halogen-free polymer is used as the material for the insulation 2. In a preferred case, the insulation 2 is of polyethylene. This material has outstanding electrical properties. It is therefore most suitable for HF lines. However, the plastics material of insulation 2 can alternatively comprise another polymer, for example, polypropylene. The materials referred to are all easily combustible; for many uses, therefore, the HF line must be so designed that the insulation 2 cannot burn.

For this purpose, a band 4 consisting of a glass fabric provided on one side with a metal layer is wound on around the screening 3, so as to overlap. The metal layer covers the band 4 over its entire length and width. It can consist, for example, of aluminium or copper. The metal layer is on the outside. A sheath 5 of insulating material is provided around the band 4 to protect it. The sheath 5 can consist, for example, of a flame-resistant copolymer of ethylene.

In the case of Figures 3 and 4, a semiconducting layer 6, around which the screening 3 is laid, can also be provided around the insulation 2. The layer 6 serves to prevent microphony.

The electrical line of the invention, having the construction of the illustrated embodiments, is flame-resistant. It does not burn even under great heat or in the region of an open flame. In the region of an open flame, only the sheath 5 melts, so that the band 4 or the metal layer of the latter is

exposed. The band 4 forms a barrier against open flames. It has a flame-inhibiting effect, so that the enclosed electrical line, and particularly the insulation 2, which in itself is combustible, will be effectively protected. This is true even at temperatures exceeding 1000°.

Because the band 4 is wound on so as to overlap, it has the same effect as a closed metal tube would have against flames. However, in this tube there are sufficiently large gaps to allow gases generated inside to escape. This is necessary at very high temperatures, at which the material of the insulation 2 decomposes.

Although the overlapping of the individual turns of the band 4 should not be so great as to inhibit gas escape, it should also not be so small that the closed layer formed by the band 4 might open when the line is bent. The width "B" of the overlap should therefore be between 7% and 35% of the width of the band 4. It is preferred that the width of the overlap is approximately 20%.



CLAIMS

1. A flame-resistant electrical line comprising at least one electrical conductor, an insulation surrounding the latter, and a glass-fabric band which is wound round the insulated conductor, with overlapping edges, and which is provided on one side with a metal layer, wherein the insulation of the at least one conductor is composed of a plastics material comprising a halogen-free polymer, a metal screening is laid around the insulation, the said band, with the metal layer on the outside, is wound around the screening, the width of the overlap of the said overlapping edges is between 7% and 35% of the width of the said band, and a sheath composed of an insulating material is applied around the band.
2. An electrical line according to claim 1, wherein the width of the said overlap is approximately 20% of the width of the band.
3. An electrical line according to claim 1 or 2, wherein a layer of semiconducting material is provided between the insulation and the screening.
4. An electrical line according to claim 1, 2 or 3, wherein the screening is a screening produced by braiding or stranding.
5. An electrical line according to claim 1, 2 or 3, wherein the screening consists of a metal band wound on to or folded longitudinally around the insulation.
6. An electrical line according to any of claims 1 to 5, wherein the insulation comprises polyethylene.
7. An electrical line according to any of claims 1 to 6, wherein the sheath comprises a flame-resistant copolymer of ethylene.
8. An electrical line according to claim 1, substantially as described with reference to



Figures 1 and 2, or Figures 3 and 4, of the accompanying drawings.

9. An electrical line according to any of claims 1 to 8 when used as a high-frequency line.

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