March 18, 1969 R. S. PRICE 3,433,687

METHOD OF REPAIRING LOW-NOISE TRANSMISSION CABLE

Filed June 17, 1966

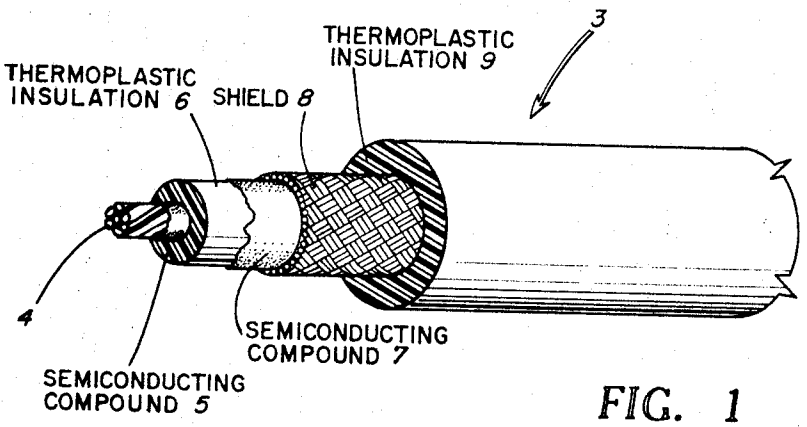


FIG. 1

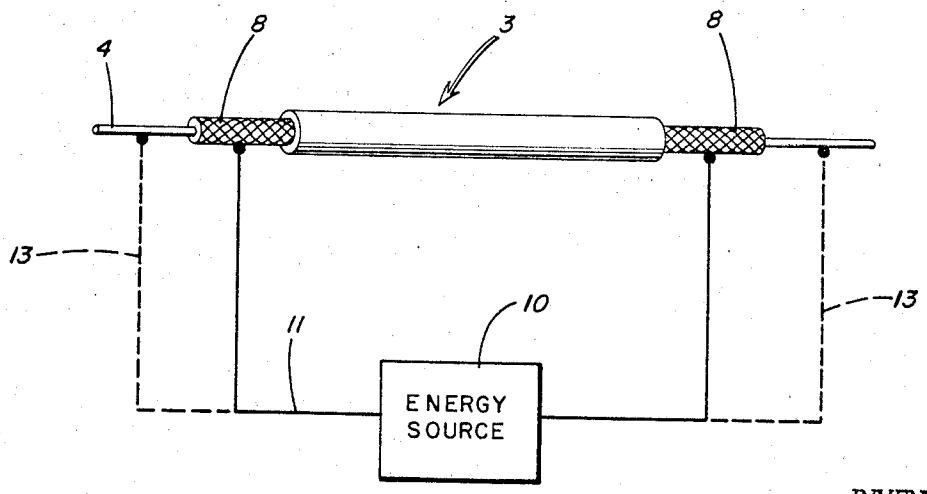


FIG. 2

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United States Patent Office 3,433,687
Patented Mar. 18, 1969

3,433,687

METHOD OF REPAIRING LOW-NOISE TRANSMISSION CABLE

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Filed June 17, 1966, Ser. No. 559,052
U.S. Cl. 156—47 3 Claims
Int. Cl. H01b 13/00

ABSTRACT OF THE DISCLOSURE

A method of making low-noise coaxial cable wherein the coaxial cable is heated by passing a large pulse of energy through a braided copper shield or through a central conductor so that adjacent dielectric material is partially melted to form a more intimate bond with the shield or conductor.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalty thereon or therefor.

This invention relates generally to coaxial cable, and more particularly to a method and apparatus for making or improving low noise transmission cable.

Coaxial cables are used for many purposes, one of which is the transmission of broad band, low amplitude transient signals, as, for example, in the transmission of signals from a piezoelectrotransducer to a recording system. If the transmission cable is exposed to conditions causing flexing or crushing, the various parts of the cable may be temporarily displaced relative to one another and the size of voids existing in the cable may be changed. These effects are believed to cause the generation of spurious signals or noise. Those concerned with development of coaxial cable have long recognized the need for a signal free or low noise cable and existing signal-free cables are designed to reduce the amplitude of the spurious signals. Among known methods of reducing the spurious signals are the addition of aluminum powder or graphite paste to the central conductor and between the coaxial insulation and metallic shield.

Though cable of excellent quality has been produced, great variation in the signal free quality has been detected. Upon investigation it was found that voids or small spaces were formed in the cable when it is manufactured. The voids exist between the metallic electrically conducting portions of the cable and the nonmetallic, insulating portions of the cable and amongst the strands of the metallic portions. When a voltage is impresed across the cable, the various voids act as the insulation or gap of tiny capacitors. When the voids are changed in shape or volume by flexing or crushing of the cable, the capacitances vary but the charge does not. As a result the voltage must change and this change appears as noise.

It has been found that by reducing the voids, or immobilizing the cable parts, the noise is reduced. At present there is no way to completely accomplish the above. Furthermore, flexing of the cable seems to establish new voids or loosen the structure of the cable, thereby decreasing the effectiveness of whatever system of noise reduction had been built into the cable. The present invention fulfills the need for a low-noise signal free transmission cable.

An object of the present invention is to provide an improved method for producing low-noise coaxial cable.

Another object of this invention is to provide a method for improving presently available coaxial cables.

A further object of the present invention is to reduce

the extraneous electrical signals generated when a coaxial cable is flexed.

Still another object of the present invention is to decrease the noise level of newly manufactured cable and to improve the low-noise characteristics of older cable that has been exposed to considerable use.

In accordance with the present invention the foregoing and other objects are obtained by heating a coaxial cable by passing a large pulse of energy through a braided copper shield or through a central conductor so that the adjacent dielectric material, preferably polyethylene insulation, is partially melted to form a more intimate bond with the shield or conductor and with a semiconducting compound in contact with the polyethylene.

Other objects and advantages of the invention will hereinafter become more fully apparent from the following description in connection with the drawings, which illustrate a prefered embodiment, and wherein:

FIG. 1 shows the construction of a typical coaxial cable; and

FIG. 2 shows a treatment set up for the coaxial cable of FIG. 1.

Referring now to the drawing, wherein like reference characters designate like or corresponding parts throughout the several views, there is shown in FIG. 1 a coaxial cable **3** consisting of a stranded copper central conductor **4** coated with a semiconducting compound **5**, such as graphite or aluminum powder, which is further surrounded by a thermoplastic material, such as polyethylene insulation **6**. The polyethylene insulation is also coated with a semiconducting compound **7**, which may be the same as the semiconducting compound **5** used on the copper central conductor. A braided copper shield **8** is then placed around the coating of semiconducting compound **7**. Finally, the braided copper shield is covered with a thermoplastic material, such as neoprene jacket **9**. If needed the copper shield may be surrounded by a cotton or fiber wrapping (not shown) to prevent the neoprene from entering the shield and removing the semiconducting compound from the insulation.

Referring now to FIG. 2, a schematic view of a setup for treating the cable of FIG. 1 is shown. In this setup, a source of energy **10**, such as an A.C. or D.C. pulse generator, is shown attached to the braided copper shielding **8** of the coaxial cable **3** by leads **11**. When the power source is initiated a large predetermined amount of electric current is passed through the copper shielding for a predetermined time to rapidly heat the shielding. This heating melts the adjacent polyethylene which then forms a more intimate bond with the shield and the semiconducting compound. Since heat is applied for only a short time the entire mass of polyethylene does not melt and its insulation properties are not impaired. This intimate bonding of the polyethylene with the shielding and semiconducting compound greatly increases the antimicrophonic qualities of the cable. The method described above may also be applied to the central conductor **4** of the coaxial cable, to reduce the noise generation between the central conductor and the polyethylene. In this heating process the power source **10** would be connected by leads **13**, shown in phantom line in FIG. 2 to both ends of the central conductor. The power source would then be initiated to melt the polyethylene insulation to form a more intimate bond between it, the central conductor and the semiconducting compound. This method is essentially a repairing procedure for cable that was not properly built in the first place or cable that has lost its antimicrophonic qualities through constant use.

New cable could also be constructed by heating the polyethylene during assembly. This could be performed by applying a layer of polyethylene over the semiconductor

coated shield in an enclosed chamber at such a temperature that a good bond of polyethylene outside and inside the shield would be obtained. The polyethylene would have to be in a semifluid state in order that the shield could be properly bonded thereto. If considered desirable, the shield could be completely buried in polyethylene. An additional jacket, if wanted, could then be applied outside of the polyethylene for further insulation and mechanical protection purposes.

The process is primarily applicable to cables having an insulation which is thermoplastic since nonthermoplastic materials would not flow when heated. This method could be applied to polypropylene and vinyl insulated cables, if desired. With the type of noise encountered in coaxial cables, vinyl probably does not have a large enough specific resistance to permit its use.

It is contemplated that other methods of heating the cable may be used, for instance, in making new cable, the polyethylene might still be hot from an extrusion process, when the shield and semiconducting compound are applied. Still further, if old cable has to be removed from a reel it could be run through an induction coil or furnace to heat a short length of cable, the duration of heat application would depend on the rate of cable movement. Various combinations of current, time and temperature will be necesesary for treating different cable constructions and to obtain the best results. This would depend on the size of the cable and the type of shielding used.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. The method of repairing coaxial cable to reduce voids and the generation of spurious electrical signals, the cable having a central conductor coated with a semiconducting compound and surrounded by a thermoplastic material which is also coated with a semiconducting material and is in turn surrounded by a braided outer conductor, comprising the following steps:

passing a large predetermined pulse of electrical energy through one of the conductors;

maintaining the application of said electrical energy for a predetermined short period of time to rapidly heat said conductor so that only the insulation adjacent to said conductor melts to form a more intimate bond with the semiconducting compound and the conductor of the cable.

2. The method of claim 1 wherein the electrical energy is passed through the braided outer conductor of the cable.

3. The method of claim 1 in which the electrical energy is passed through the central conductor of the cable.

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US. Cl. X.R.

156—275; 174—102, 110, 36, 127