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HIGH-VOLTAGE CABLE

Filed June 20, 1962

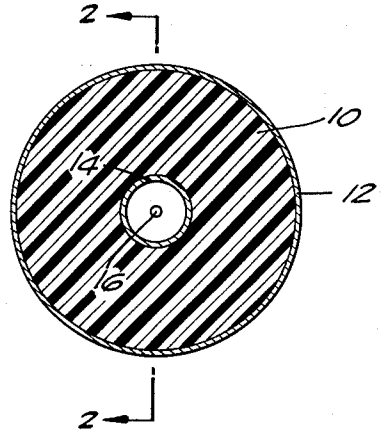


FIG. 1.

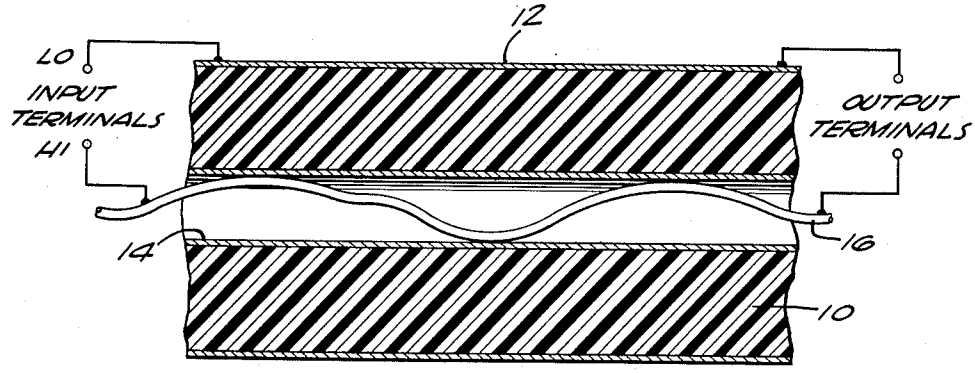


FIG. 2.

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HIGH-VOLTAGE CABLE

James E. Webb, administrator of the National Aeronautics and Space Administration, with respect to an invention of Walter F. Krieve

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5 Claims. (Cl. 174—115)

This invention relates to cables for use in radiation fields and, more particularly, to improvements therein.

When the usual type of high-voltage cable is sought to be used in fields of high-intensity ionizing radiation, the amount of leakage current occurring across the cable insulation may be sufficently large to cause breakdown and to prevent the use of the cable for the purpose intended. In any event, for obtaining the best results in the operation of equipment, it is desirable to minimize the leakage current of cables used with that equipment.

An object of this invention is the provision of a novel and improved high-voltage cable for use in fields of high-intensity ionizing radiation.

Another object of this invention is the provision of a high-voltage cable which, in fields of high-intensity ionizing radiation, minimizes or neutralizes leakage current.

Yet another object of this invention is the provision of a high-voltage cable which can carry high voltages in a high-intensity ionizing radiation field without breakdown.

These and other objects of the invention may be obtained in an arrangement comprising an insulating tubing having a hollow center. The inner wall of the tubing is coated with a thin conductive coating, and the outer wall of the tubing is coated with a conductive coating. A thin conductor, preferably made of a high-density metal, such as platinum, extends through the center cavity and touches or is in contact with the coating on the inner wall at various places along the length thereof. The thin conductor has high potential applied thereto, and the coating on the outside of the tubing is the ground connection. Gamma rays of the ionization field cause a liberation of electrons from the conductor which travel outward to the outer conductive coating, thus providing a current flow opposite to the one caused by the liberation of electrons due to the gamma ray bombardment of the insulating tube.

The novel features that are considered characteristic of this invention are set forth with particularity in the appended claims. The invention itself, both as to its organization and method of operation, as well as additional objects and advantages thereof, will best be understood from the following description when read in connection with the accompanying drawings, in which:

FIGURE 1 is a transverse cross section of the invention; and

FIGURE 2 is a longitudinal cross section of the invention.

Referring now to the drawings, FIGURES 1 and 2 respectively show transverse and longitudinal cross-sectional views of the invention. This comprises a thick-walled tube 10 of insulating material, having its outer wall covered with a conductive coating 12. The center of the tube is hollow, and the inner wall of the tube, which defines its hollow center, is also covered with a conductive coating 14.

A wire or conductor 16, preferably of a dense metal, extends through the hollow center of the tube. The diameter of the conductor is made small relative to the diameter of the tube or hollow center. The conductor is permitted to contact the conductive coating at the inner wall at various locations along its length, as shown in the drawings.

In a preferred embodiment of the invention, the insulating tube was made of quartz and the high-density conductor was made of platinum. The thickness of the conductive coating on the tube inner wall was thin, especially when compared to the thickness of the coating on the outer wall of the tube.

In operation, the conductor 16 is connected to the high-voltage side of whatever equipment is being used, and the conductive coating 12 on the tube outside wall is connected to the low-voltage or ground side. Despite the fact that the conductor 16 is made very thin, which would ordinarily produce a high electric-field gradient around the wire, with possible dielectric breakdown, such breakdown does not occur by reason of the fact that the conductor is surrounded by the conductive coating 14, which it occasionally touches. Thus, the electric-field gradient spreads out from the larger circumference of the conductive coating 14 whereby it is made much lower in intensity, instead of from the conductor 16.

Any part or all of the invention may be located in a field of ionizing radiation, and it will display little or no current leakage. When gamma rays of the ionization field strike the conductor 16, electrons are liberated which fly through the coating 14 into the insulator tube 10. These electrons drift to the outer conductive coating 12. Such electron flow occurs even though the conductor is at a higher potential than the outer coating 12. The inner wire 16 is made of as dense a material as possible, to obtain as many electrons as possible as a result of the gamma-ray bombardment of the wire. The electrons are liberated due to the Compton effect, which teaches that the number of these electrons increases with the increase in mass of the body irradiated. Because of the small diameter of the inner conductor, as few Compton electrons as possible are intercepted by the conductor, which electrons are liberated by Compton interactions within the insulator tube near its inner circumference.

The high-voltage cable geometry just described is also useful as a high-voltage Compton cell. When the insulator has its ends open-circuited and is placed in a field of ionizing radiation, gamma rays striking the inner wire cause it to emit electrons, which fly to the insulator and cause electrons to drift to the outer conductive coating. This makes the outer coating the negative terminal of an electric cell having the inner wire as its positive terminal. Currents at high voltages will be provided by this cell.

The high-voltage cable may also be used as a radiation detector for high-intensity fields. The efficiency of the device results in a current output, even for relatively low-radiation fields, so that the device is useful for monitoring a wide range of intensities. The device yields a current output roughly proportional to the ionizing radiation.

There has accordingly been described and shown herein a novel, useful, and improved high-voltage cable for use in radiation fields wherein materials and mass of materials are selected so that the current flow of Compton interaction is reverse to and of the same magnitude as current flow due to the conductance of the insulation of the cable in the field of ionizing radiation.

I claim:

1. A cable for use in radiation fields comprising an elongated member made of insulating material and having a hollow center, said elongated member having an outside wall and an inside wall surrounding said hollow center, a conductive coating on the outside wall of said elongated member, a conductive coating on the inside wall of said elongated member, and a conductor extending through said hollow center and contacting the coating on the inside wall of said elongated member at spaced locations therealong, said conductor diameter being small relative to the diameter of said hollow center.

2. A cable for use in a radiation field comprising an elongated tubular member made of insulating material and having outside walls and inside walls defining a hollow center, a first conductive coating on the outside walls, a second conductive coating on the inside walls, said

second conductive coating being thin relative to said first conductive coating, and a conductor extending through said hollow center and contacting said second conductive coating at spaced locations therealong, said conductor diameter being small when compared to the diameter of said hollow center, said tubular member diameter being large when compared to the diameter of its hollow center.

3. A cable as recited in claim 2 wherein said conductor is made of a dense metal.

4. A cable as recited in claim 2 wherein said tubular member is made of quartz.

5. A cable for use in a radiation field comprising an elongated quartz tube having outside walls and inside walls defining a hollow center, a first conductive coating on said outside walls, a second conductive coating on said inside walls, said second conductive coating being thin relative to said first conductive coating, and a platinum conductor extending through said hollow center, said conductor diameter being small relative to the diameter of the hollow center including said second conductive coating, said conductor being in contact with said second conductive coating at spaced locations therealong.

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