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COAXIAL CONDUCTOR SYSTEM

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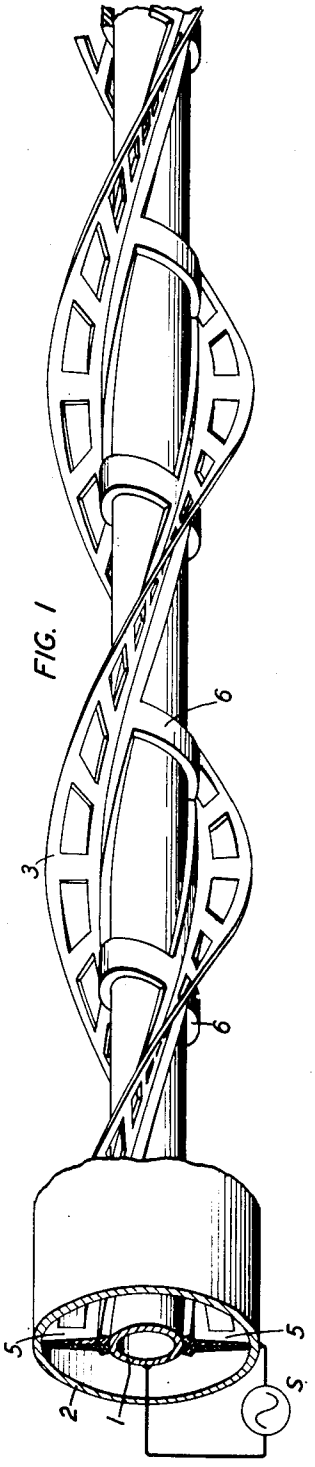

FIG. 1

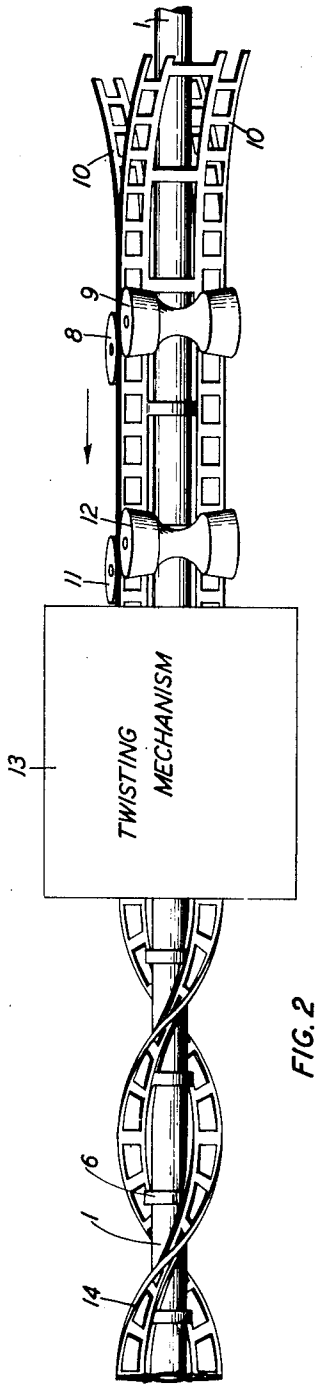

FIG. 2

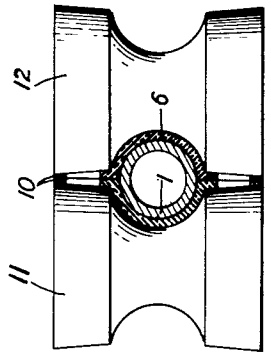

FIG. 3

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COAXIAL CONDUCTOR SYSTEM

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7 Claims. (Cl. 173—265)

This invention relates to concentric conductor systems for the transmission of intelligence and more particularly to the mechanical structure of such systems.

For the transmission of a wide range of signaling frequencies extending upwards to the order of a million cycles per second, a concentric arrangement of conductors has been found desirable. As ordinarily constructed such a system comprises a central conductor, either tubular or solid, and an outer, tubular conductor concentric therewith and connected as a return circuit. To maintain the two conductors in their concentric relation beads or washers of insulating material have sometimes been provided at intervals along the central conductor. In other cases a continuous structure, such as provided by winding a strip of insulating material on edge in the form of a spiral about the central conductor, has been proposed. Because of the extremely high frequencies involved it is essential that a minimum of insulating material be employed between the conductors in order to keep the dielectric losses at a reasonable value. At the same time, since the conductors may be subjected to bending and rough treatment during manufacture and installation, flexibility and ruggedness are required of the separating structure.

An object of the present invention is to improve the mechanical properties of a concentric conductor system.

A separator for concentric conductor systems in accordance with the present invention provides, in effect, two thin, spiral flanges of insulating material on the central conductor, the spirals being so arranged that the central conductor is supported from opposite sides at every point of its length. A tubular insulating member immediately surrounds the central conductor, and the flanges, by virtue of their integral connection therewith, are held firmly in place, any tendency for the turns of the spiral to "bunch" being precluded. The pitch of the spirals is made relatively large, so that the dielectric between the conductors may be chiefly air.

In the preferred method of manufacturing the separator, the central conductor is placed longitudinally between two wide strips of insulating material, such as cellulose acetate, the edges of the strips being cemented together to form flanges on opposite sides of the conductors. The whole structure is then passed through suitable apparatus to impart the desired helical twist to the insulator.

The nature of the present invention will appear more fully in the following description of a preferred embodiment of it, reference being made to the accompanying drawing, in which:

Fig. 1 shows diagrammatically a concentric conductor system in accordance with the invention;

Fig. 2 shows a preferred method of forming the separator; and

Fig. 3 shows a detail of the apparatus used in the manufacturing process.

Referring now to Fig. 1, there is shown a concentric conductor system comprising a central conductor 1 maintained in concentric relation with an outer, tubular conductor 2 by means of a separating member 3. Connected to the conductors is represented a source of signaling waves S, which may be adapted to produce modulated carrier waves extending in frequency well up into the radio frequency range. The construction of the conductors themselves forms no part of the present invention, which may be employed whether the conductors are heavy and rigid or thin and flexible. The central conductor may be a solid copper wire, a hollow conductor as shown in the drawing, or it may be stranded.

The separator 3 in its completed form provides a pair of thin, strip-like members 5 of insulating material wound edgewise on opposite sides of the central conductor in the form of helices. The two helical members are held firmly in their positions by a tubular structure 6 of insulating material which surrounds the central conductor and with which the helices are integral. To reduce the amount of solid dielectric between the conductors and thereby to reduce the capacitance and conductance of the system, as much material may be removed from the separator as is not required for mechanical strength. Any suitable insulating material, such as cellulose acetate and hard rubber of certain grades, may be used for the separator. Preferably it should have a low dielectric constant and low dielectric loss, and be stiff enough to support the central conductor, yet flexible enough to permit bending and reeling.

Fig. 2 illustrates diagrammatically one method of forming the separator. Two wide tapes 10 of insulating material with the central conductor 1 longitudinally between them are fed between rollers 8 and 9 and between the succeeding rollers 11 and 12, which are designed to press the material to the shape of the conductor and to press the overlapping portions of the tapes firmly together. The inner surfaces of the tapes may

be rendered adherent by treatment with a suitable chemical solution or by heat, and in passing through the rollers they are firmly welded together, thus forming a flange or fin on each side of the central, cylindrical part. Preferably, the insulating tapes are perforated so that as little material is used as the mechanical requirements permit. The resultant structure is then passed through any suitable mechanism 13 to twist the insulating material to the form of a helix. The central conductor with its helical insulator 14 may then be cut into convenient lengths for reeling.

The twisting operation may tend to strain the insulating material, particularly near the edges of the tapes. By tapering rollers 11 and 12 as shown in Fig. 3, more material is provided where required and the strain is reduced.

It is obvious that various modifications of the specific structure and process described herein may be made within the present invention, which is to be limited only by the scope and spirit of the appended claims.

What is claimed is:

1. A conducting system for the transmission of intelligence comprising a tubular outer conductor, a cylindrical inner conductor, a double helix of insulating material comprised of thin strips disposed edgewise on said inner conductor continuously along its length for maintaining said conductors in concentric relation, and means for fixing the relative axial positions of said strips comprising insulating material integrally connecting said strips.

2. A conducting system adapted to transmit frequencies of the order of a megacycle per second, comprising a central conductor, a tubular return conductor concentric therewith, a plurality of thin, flat strips of insulating material disposed edgewise on said central conductor continuously along its length in the form of helices and adapted to support said central conductor within said tubular conductor, and insulating material joining said helices for maintaining their relative axial positions, the dielectric between said conductors being substantially gaseous.

3. A concentric conductor system comprising a central conductor, an outer, return conductor and an insulator separating said conductors, said insulator comprising a layer of insulating material about said central conductor and a helical flange of insulating material integral therewith and adapted to maintain said conductors in fixed spacial relation.

4. A conducting system comprising an inner cylindrical conductor, a hollow cylindrical return conductor disposed thereabout, and insulating means separating said conductors, said means comprising a tube of insulating material over said inner conductor and a plurality of thin helical strips of insulating material integral with said tube of insulating material and adapted to support said inner conductor in concentric relation to said hollow conductor.

5. A conducting system comprised of concentrically arranged cylindrical conductors and an insulator separating said conductors, said insulator comprising two wide strips of insulating material disposed face to face with the inner of said conductors enclosed longitudinally between them, the projecting portions of said tapes being united and the complete insulator structure being twisted to form a plurality of helical flanges.

6. The method of manufacturing an insulator adapted to separate the cylindrical conductors of a concentric conductor system, which comprises applying two wide strips of insulating material to opposite sides of a cylindrical conductor, joining the projecting edges of said tapes to form two flanges, and twisting the resultant insulator structure to form helices of said flanges.

7. A high frequency conducting system comprising a central conductor, a tubular return conductor concentric therewith, an elongated insulating member wound helically about said central conductor for maintaining said conductors in concentric relation, and insulating material joining the turns of said helical member for fixing the pitch thereof, the dielectric between said conductors being chiefly gaseous.

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