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C. KREISHER

2,080,491

CONDUCTING SYSTEM

Filed Jan. 23, 1935

FIG. 1

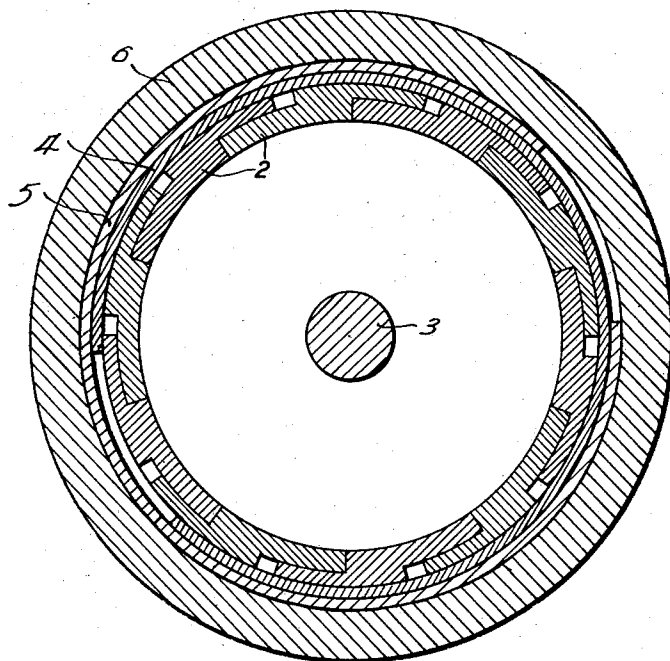
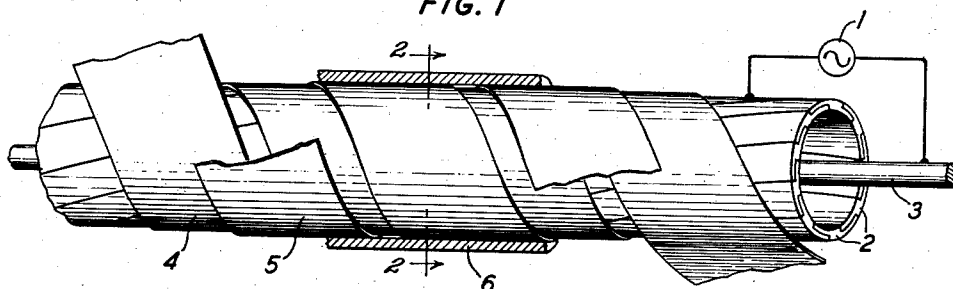


FIG. 2

FIG. 3

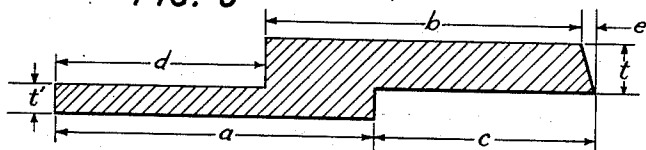
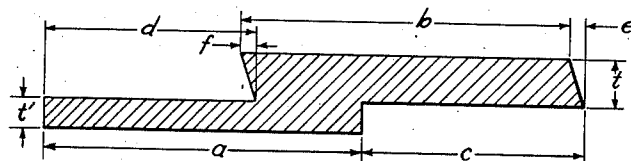


FIG. 4



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2,080,491

CONDUCTING SYSTEM

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2 Claims. (Cl. 173-13)

This invention relates to hollow conductors and to the manufacture thereof and more particularly to the design and manufacture of coaxial conductor cables.

5 For the conduction of high frequency electrical signals it is well-known to employ a cable comprising a tubular outer conductor and a central return wire coaxial therewith. To provide greater flexibility than can be obtained with copper tubing and at the same time to retain the electrical advantages of the latter type of conductor, it has been proposed to construct the outer conductor of a plurality of profiled strips which are arranged to engage one another and 10 which are held to a tubular shape by means of an external binding member. Such a construction is shown in U. S. Patent 2,018,477, issued October 22, 1935 to J. F. Wentz.

In accordance with the present invention there is provided a coaxial conductor system of the type to which reference has been made, in which the profile of the individual strips is designed to improve the electrical and mechanical properties of the conducting system and to reduce the 20 amount of conducting material required.

The electrical and mechanical characteristics which a tubular conductor must have to make it suitable for use in a coaxial conductor system, are not readily obtainable by the use of profiled strips. In the first place, the space between the central conductor and the tubular conductor is essentially gaseous, only so much solid material being interposed as is necessary to maintain the central conductor in position. The use of 30 internal supporting elements for a collapsible composite structure, therefore, is necessarily restricted. The thinness of the tubular conductor introduces another difficulty. Flexibility as well as economy dictates that the wall thickness be of the order of only 20 or 30 thousandths of an inch. Diameters may be as small as a quarter of an inch. With these dimensions it is difficult, if not impossible, to produce a rugged self-supporting conductor by the use of ordinary interlocking 45 profiled strips. A third restriction is imposed on the length of lay of the strips. Where the strips are interlocked against relative radial movement, as in a tongue and groove construction, added strength may be obtained by spiraling the strips. A short spiral, although it improves the mechanical characteristics, increases the effective resistance of the tubular conductor and introduces an undesirable circular component of current. For this reason it is almost essential in 55

many cases that the length of lay be at least ten times the internal diameter of the conductor.

The various features and objects of the improvements which constitute the present invention will appear in the following detailed description of specific embodiments of the invention. Reference will be made to the accompanying drawing, in which:

Fig. 1 shows a composite tubular conductor and a coaxial conductor system of the type to which 10 the present invention relates;

Fig. 2 is a cross-sectional view of a coaxial conductor pair in accordance with the invention; and

Figs. 3 and 4 show the profiles of two forms of 15 the component strips that embody the invention.

Referring now to Fig. 1, which shows a coaxial conductor system of the type to which the present invention relates, the wave source 1 connected between the composite outer conductor 20 and the central conductor 3 represents the terminal circuits of a carrier telephone wide-band high frequency transmission system, as shown for example in M. E. Strieby Patent 1,941,116, December 26, 1933, or any other suitable source 25 of signals. The outer conductor, which may be of the order of a fraction of an inch in diameter, comprises a plurality of profiled strips 2 arranged in overlapping fashion and held together in tubular form by means of the thin steel binding tapes 30 4 and 5. A protective lead sheath 6 may be extruded over the assemblage as shown. Any suitable means may be employed to maintain the conductor 3 in its central position, although preferably slotted washers pressed on to the central 35 wire at intervals of the order of three-quarters of an inch are employed for this purpose.

Fig. 2 is a cross-sectional view of the coaxial conductor pair shown in Fig. 1. Fig. 3 shows one of the profiled strips in detail. Fig. 3 is drawn 40 to scale as is also Fig. 4.

Heretofore tubular conductors of the type shown have been made up of profiled strips, similar in several respects to those shown in Figs. 3 and 4 but in which all angles were right angles. Applicant has found that the tendency of one profiled strip to slip inwardly over an adjacent strip, particularly during the process of manufacture, is greatly reduced and a much more rugged structure obtained if the outer edge of the inner portion of each strip is beveled in the manner shown in Figs. 2 and 3. Furthermore, with the construction shown the strips fit together more tightly and over the entire abutting 55

surfaces. Failure to provide a tight fit between strips so that a smooth interior surface is obtained has been found to cause a substantial increase in the high frequency resistance of the conducting system.

In Fig. 4 is shown another form of profile in accordance with the invention. In this case, both edges of the inner portion of the strips are beveled. Since, however, the central bevel cannot readily be provided by rolling machines, the construction shown in Fig. 3 is preferred.

In one specific preferred embodiment in accordance with Fig. 3 where the nominal inside diameter of the conductor was 0.27 inch and nine strips were used, the dimensions in mils were as follows: *a*, 95.3; *b*, 95.3; *c*, 67.6; *d*, 65.2; *e*, 5.0; *t*, 12.4; and *t'*, 9.2.

In one embodiment in accordance with Fig. 4 where ten strips were used and the inside diameter of the conductor was approximately three-eighths of an inch, the proportions of the strip were as follows: *a*, 100; *b*, 100; *c*, 71; *d*, 67; *t*, 17.6; *t'*, 8.8; *e* and *f*, such that the angle of bevel was of the order of 70 or 75 degrees.

A feature of the construction herein disclosed is that only the inner portion of the strips are or need be in abutting relation. The dimension *a* can be reduced so that a substantial gap is left between the outer portions, as indicated in Fig. 2.

Another feature of the construction is that the inner portion of each strip is thicker than the outer portion. These inner portions are essentially compression members, hence greater ruggedness results from an increase in their thickness. Moreover, the low frequency attenuation of the coaxial conducting system is reduced since

at low frequencies skin effect is not great enough to confine the alternating currents to the inner surface of the conductor.

Various modifications of the structures herein described for purposes of illustration will be obvious to those skilled in the art. The scope of the invention is defined in the appended claims.

What is claimed is:

1. A flexible tubular conductor made up of a plurality of integral profiled strips each comprising two laterally elongated portions laterally offset from each other, the edge of one of said portions forming a substantially square shoulder with the face of the other of said portions and the other edge of said one portion being beveled, so that as said strips are assembled in overlapping relation in said conductor the beveled edge of each strip is in complete abutment with the said shoulder of an adjacent strip.

2. A flexible tubular conductor made up of a plurality of interengaging profiled strips and an external restricting member retaining said strips in assemblage, each of said strips comprising two flat strip-like portions of unequal thickness laterally offset from each other, one edge of the thicker of said portions meeting the face of the other of said portions at substantially right angles and the other edge of said thicker portion being so beveled that as said strips are assembled in overlapping relation in said conductor with the said thicker portions forming the interior surface of said conductor, the edges of said thicker portions of adjacent strips are in intimate contact over the entire surface of said edges.

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