May 30, 1961 H. KENT 2,986,713

CORRUGATED FLEXIBLE WAVE GUIDE

Filed April 29, 1958

Fig. 1

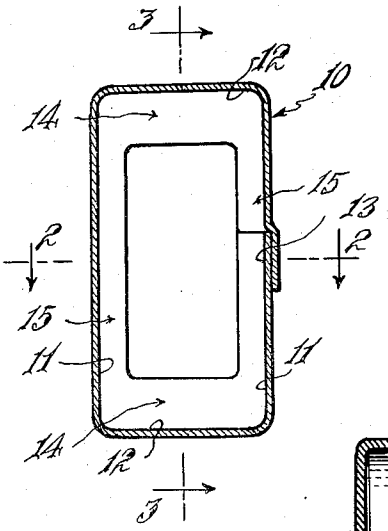


Fig. 2

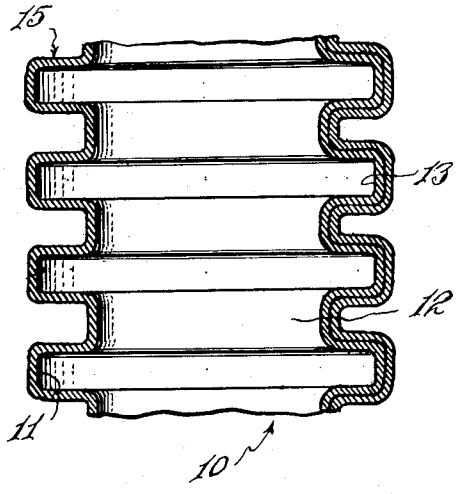
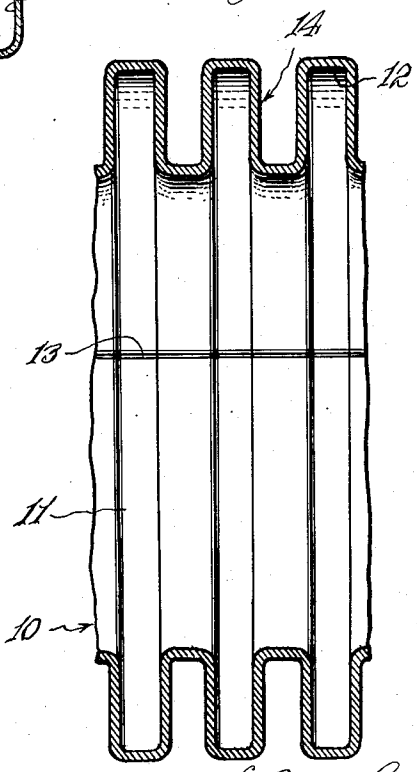


Fig. 3



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CORRUGATED FLEXIBLE WAVE GUIDE

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1 Claim. (Cl. 333—95)

The invention relates in general to flexible wave guides used for making a connection between rigid wave guides or other elements of a high frequency (very high frequency through extremely high frequency) electric current transmission line, and has particular reference to a longitudinally corrugated wave guide of rectangular cross-section wherein the corrugations are disposed in the side walls at right angles to the longitudinal axis of the guide.

The type of wave guide to which the invention relates is disclosed in United States Patent No. 2,600,169, issued to John M. Lamb on June 10, 1952. In fact, the present invention is a specific improvement in the electrical and mechanical arrangement and dimensions of the corrugations along the respective narrow and broad walls of the wave guide as compared with the corrugations in the said patented device.

For clarity of reference, the above-mentioned patented device will be referred to hereinafter as "the said patented wave guide."

Prior to my present invention, and particularly in the construction of the said patented wave guide, it has been the practice to make the corrugations along all walls of wave guides of the type disclosed equal in radial height in relation to the longitudinal guide axis. As a result, the impedance of such a flexible wave guide fails to match the impedance of a rigid wave guide to which the former may be connected when flexing of the former occurs. This is because, in order to match the impedance of the rigid wave guide, the inside dimension of the flexible guide must match the inside dimension of the rigid guide, along the narrow side walls, and, along the broad walls, the medium dimension of the flexible guide must match the inside dimension of the rigid guide. In other words, the power handling capacity is limited or degraded by approximately one corrugation or ridge and valley extent.

It, therefore, is the primary object of my present invention to provide a construction of corrugations along the respective broad and narrow side walls of a flexible wave guide which will effect the desired matching of impedance with that of an interconnected rigid wave guide.

To be more explicit, it was discovered, after considerable experimentation with corrugated structures, that, by making the radial height of the corrugations along the narrow side walls substantially twice the height of the corrugations along the broad walls, the effect is to require a larger narrow dimension for the flexible to match the rigid impedance. Incidentally, this has the effect of making the flexible guide capable of equal deflections in both the plane of the broad walls and the plane of the narrow walls with the same degree of electrical degradation. This is a definite advantage because, in the prior art construction where the corrugations are of the same radial height in both the narrow and broad walls, the allowable bending angles in the plane of the narrow walls was always one-half that in the plane of the broad walls. In some instances, this meant that the wave guide had to

be twisted torsionally in order to rotate it into a condition in which it would be possible to take advantage of the shorter bending radii in the plane of the broad walls, which expedient merely added to the complexity of the system. Naturally, it is my object to provide a guide that is capable of being flexed equally well in both planes without any twisting.

Other objects, advantages and features of the invention will become apparent as the following specific description is read in connection with the accompanying drawing, in which:

Fig. 1 is a transverse section of a flexible wave guide constructed in accordance with the present invention;

Fig. 2 is a longitudinal section on line 2—2 of Fig. 1; and

Fig. 3 is a similar view on line 3—3 of Fig. 1.

Referring now in detail to the drawing, wherein like reference characters designate corresponding parts in the several views, it will be observed that wave guide **10**, which corresponds to the "innercore" of the said patented wave guide, is rectangular in transverse section as shown in Fig. 1, and comprises parallel broad side walls **11—11** and parallel narrow side walls **12—12** formed at right angles to said wide side walls. The optimum cross section of the tubular guide must be in the ratio of 2 to 1 electrically. The finished wave guide **10** may be fabricated by extrusion processes, but preferably is bent into tubular form from a flat wide strip, or blank, of suitable electrical conducting metal, such as cartridge brass, which has been corrugated previous to the in-bending step and which subsequently is united at its longitudinal edges by an electrically and mechanically closed seam **13**.

As previously explained in the preamble to this specification, the novel feature of the present invention resides in the difference between the construction and dimensions of the corrugations in the narrow side walls **12—12** and the construction and dimensions of those in the wide side walls **11—11**. As shown in the drawing, the corrugations **14** in narrow side walls **12—12** are of substantially twice the radial height as compared to the corrugations **15** in wide side walls **11—11**. Whenever the dimensional ratio of the wide side walls of a wave guide to the narrow side walls departs from the usual 2 to 1 ratio, the radial height ratio of the corresponding corrugations will vary substantially proportionately.

The advantages of the improved construction should be apparent without further explanation.

It will be understood that it is intended to cover all changes and modifications of the example of the invention herein chosen for the purpose of illustration which do not constitute departures from the spirit of the invention and scope of the appended claim.

I claim:

A flexible wave guide constructed in the form of a rectangular tube including respectively opposed broad and narrow side walls and adapted to the propagation therethrough of ultra high frequency electrical wave energy, the broad walls being twice as wide as the narrow walls, all side walls of the tube being formed of a continuous series of uniformly spaced corrugations arranged transversely with respect to the longitudinal tube axis, the said corrugations being so constructed and arranged that the radial height thereof with respect to the longitudinal wave guide axis along the narrow side walls is twice the radial height of the corrugations along the broad walls.

References Cited in the file of this patent

UNITED STATES PATENTS

2,600,169	Lamb	June 10, 1952
2,657,364	Carr	Oct. 27, 1953