Sept. 8, 1959 W. EICHIN 2,903,657

WAVE CONDUCTOR, PARTICULARLY FOR TRAVELLING WAVE TUBES

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Fig.1

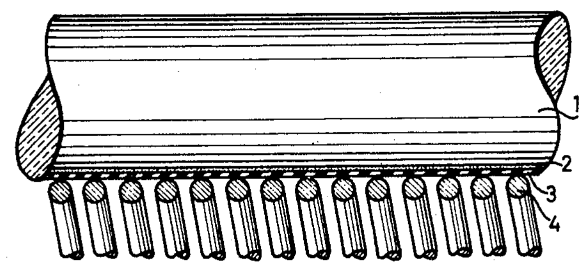


Fig.2

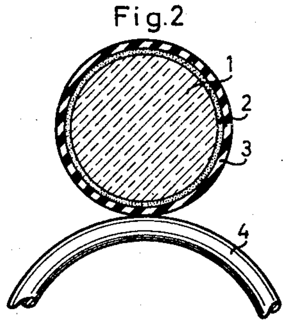


Fig.3

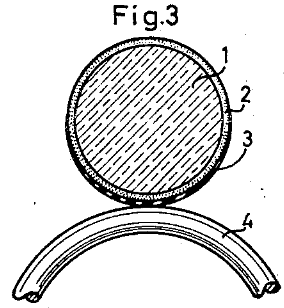
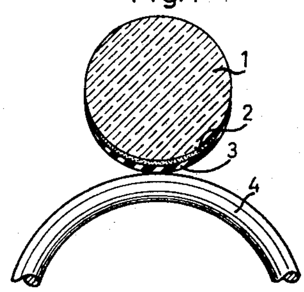


Fig.4



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WAVE CONDUCTOR, PARTICULARLY FOR TRAVELLING WAVE TUBES

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5 Claims. (Cl. 333—31)

This invention is concerned with wave conductors for travelling wave tubes.

In electronic tubes of the travelling wave type, it oftentimes is desirable to employ damped wave conductors, particularly in the form of helical retarding conductors, the damping being primarily intended to prevent autoenergization, damping occasionally also being of value in wave guides for other purposes. In either case, the damping means may be either localized or distributed.

To dampen travelling wave tubes, the general practice is to apply a damping substance, such as graphite, carbon or metal, directly to the supports for the retarding conductor, the latter usually being helical in shape. Frequently, the helix is supported on rods of quartz, ceramic, glass or other suitable insulating material, or is inserted directly in tubes of such insulating material having circular or profiled cross-section. In these instances, a damping layer generally is applied directly to the supporting elements.

While maximum damping per unit of length is normally obtained if the damping material bears directly against the helical conductor, the absolute magnitude of the total damping effect, however, is not accurately controllable in practice, since each point of engagement of the helix with the damping layer constitutes a more or less indefinite high-frequency contact that may vary upon the mere occurrence of vibrations in the helix. Moreover, it is difficult to obtain a smooth transition from the undamped portion to the damped portion of the helix.

In order to avoid these disadvantages, the present invention provides an arrangement whereby the damping layer, instead of directly engaging the helix, is arranged at a predetermined or well-defined spacing therefrom. This spacing preferably may be made as small as possible since the degree of damping per unit of length decreases as the spacing is increased.

More specifically, the present invention provides upon the damping substances a non-conductive or poorly conductive coating, at least at the points engaging the wave conductor. The properties of a material suitable for this purpose preferably include that the coating adhere firmly and that it is relatively hard in order not to be injured by the helix itself. A further consideration is that the dielectric losses should be as small as possible. Finally, and consistent with the other considerations, the coating preferably should be as homogeneous as possible and very thin, and uniformly distributed over the entire length involved.

These desirable properties are obtained to a particularly high degree by the use of a coating of quartz. This coating may, for example, be produced on the supporting elements, after the latter have been provided with the damping material, by such known expedients as vapor precipitation, cathodic atomization or the like in a vacuum. This permits the thickness of the coating to be made so small that the magnitude of the damping per unit length is practically the same as with a directly contacting layer of graphite, carbon or metal. This thickness may, for example, be from 0.1 to 1 micron.

This invention will be better understood from the following description with reference to the accompanying drawing, in which

Fig. 1 is a partially sectioned longitudinal view of one embodiment of the invention as applied to a rod-shaped supporting element with an adjacent helical retarding conductor;

Fig. 2 is a transverse section through a modification of the embodiment shown in Fig. 1;

Fig. 3 is a similar section through a further variant of the present invention; and

Fig. 4 is a similar transverse section corresponding to the embodiment shown in Fig. 1.

Fig. 1 illustrates a supporting element **1** in the form of a quartz or ceramic rod with which a helically wound retarding conductor **4** is adapted to cooperate. The outside of the supporting element **1** facing the convex side of the wave conductor **4**, is provided with damping means in the form of a thin layer **2** of graphite, carbon or metal. This layer is provided with a thin quartz coating **3**, at least at those points with which the wave conductor **4** is in engagement.

Fig. 2 shows an embodiment of the invention, in which the quartz coating **3** may cover the entire circumference of the supporting element **1**.

In the embodiment shown in Fig. 3, the quartz coating extends only over a limited arcuate zone adjacent the points of contact with the helix **4**.

In the modification illustrated in Fig. 4, the damping material is applied to only a portion of the supporting element, with the result, that the damping material may be completely covered by the quartz coating even though the latter is applied to one side only of the element **1**. This is desirable, as the expedient of completely enclosing the damping layer in a quartz envelope affords the advantage of permitting the use of damping materials which, in the absence of the protective quartz sheathing, might not be suited for use in a vacuum for purposes of this nature.

Changes may be made within the scope and spirit of the appended claims.

I claim:

1. In a travelling wave tube having a helical retarding conductor, a device for supporting said helical conductor, said device comprising a rodlike member extending in parallel with the axis of said helical conductor on the outside of the turns thereof, a layer of damping material carried by said rodlike member at points facing the turns of said helical conductor, and a relatively very thin coating of relatively hard substantially non-elastic and substantially non-conductive material having relatively very low dielectric losses, disposed upon said damping material and extending between the latter and adjacent portions of the turns of said helical conductor in direct

supporting engagement therewith, said coating providing for an impedance at the corresponding transition from the turns of said helical conductor to said damping layer which is negligibly low.

2. A structure as defined in claim 1, wherein said coating has a thickness on the order of from 0.1 to 1 micron.

3. A structure as defined in claim 1, wherein said coating consists of quartz.

4. A structure as defined in claim 1, wherein said coating envelops said damping material.

5. A structure as defined in claim 1, wherein said coating forms an outer sheathing for part of said damping material.

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