

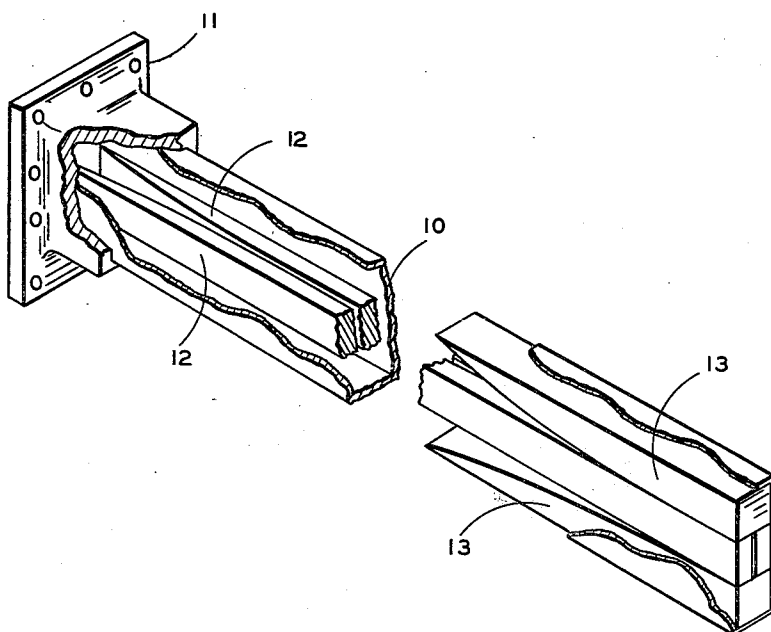
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HIGH-FREQUENCY DISSIPATING LOAD

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HIGH-FREQUENCY DISSIPATING LOAD

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This invention relates to electrical apparatus and more particularly to radio frequency power dissipating loads.

The radio frequency power dissipating load or the so-called "dummy antenna" has been constructed in a variety of forms, depending on the principle of operation, on the frequency of the R. F. energy and on the power to be dissipated. In the ultra-high-frequency range a common type of power dissipating load is the coaxial transmission line or wave guide loaded with lossy material. Where a power dissipating load, combining the properties of exceedingly high power dissipation over a broad band of frequencies with mechanically rugged construction is desired, previous power dissipating loads have in general been unsuccessful. Thus the use of a wave guide having a tapered wedge of lossy dielectric such as soapstone or some other similar material proved unsatisfactory because of the poor heat conductivity and local overheating of the dielectric as well as the mechanical fragility of the dielectric.

Accordingly an object of the present invention is to design a radio frequency power dissipating load capable of dissipating large amounts of power.

A further object of the present invention is to design such a load with a broad band frequency response.

Still another object of the present invention is to design such a load having a mechanically rugged construction.

Other objects and advantages of the invention will be apparent during the course of the following description.

In essence the invention is a radio frequency power dissipating load constructed as a section of rectangular wave guide with two internal longitudinal tapered steel ridges. The tapered steel ridges are disposed opposite one another within the wave guide and in contact with the opposite broad walls of the wave guide. The spacing between the two ridges is greatest at the input end of the wave guide, the taper of the ridges being utilized to secure a rapid lowering of the impedance with consequent increase in attenuation without introducing an excessive voltage standing wave ratio. In order to avoid local overheating of the ridges, the attenuation per unit length is made much greater at the rear end of the load than at the input end. This may be done by inserting two tapered steel metallic plugs which gradually decrease the wide dimension of the wave guide at the rear half of the load.

In the accompanying drawing forming a part of this specification, the single figure is a broken-away isometric view illustrating one embodiment of the present invention.

In the figure, numeral 10 designates a section of rectangular wave guide having a mounting fitting 11 at its input end. The fitting 11 serves to affix wave guide 10 to an R. F. power input source (not shown). Two tapered steel ridges 12 serve to lower the impedance in wave guide 10, allowing large currents to flow in the steel ridges with consequent rapid attenuation. The taper of ridges 12 permits a rapid lowering of impedance without introducing an excessive standing wave ratio.

In order to avoid localized overheating of the ridges 12, it is necessary to make the attenuation per unit length much greater towards the rear end of the wave guide 10. In order to insure a mechanically rugged construction, the minimum spacing between the ridges 12 should be of the order of 0.04 inch. Additional attenuation at the rear of the wave guide (without further decreasing the spacing between the ridges 12) may be obtained by inserting two tapered steel plugs 13. The plugs 13 and ridges 12 are in contact at the rear end of the wave guide 10. The tapered steel plugs 13 gradually effect an increase in attenuation by decreasing the broad dimension of the wave guide. The spacing between ridges 12 is substantially constant in the portion of wave guide 10 which is fitted with plugs 13.

It is apparent that there are various modifications of the invention thus far described which do not involve a significant departure from the invention. Thus only one tapered ridge 12 might be used, if desired. Wave guide 10 might be a circular or other type of wave guide. The plugs 13 may be omitted, if desired, or if unnecessary to secure the additional attenuation. While ridges 12 and plugs 13 have been described as steel, they may be constructed of a number of ferrous materials, and in general of any poorly conducting metal, if desired. Forced air or water cooling may be utilized to increase the power dissipating capacity of the load.

The taper of ridges 12 at the input end of wave guide 10 is designed to maintain a satisfactory standing wave ratio for the longest wavelength of R. F. energy.

The optimum criterion to use in the design of the tapers of ridges 12 and slugs 13 is to make the per cent change of impedance per unit of electrical length in wave guide 10, a constant. A graphical solution will in general be most fea-

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sible. Curves of guide impedance vs. ridge spacing, guide wavelength vs. ridge spacing, guide impedance vs. plug spacing and guide wavelength vs. plug spacing are plotted. In general it will be necessary to deal with the effect of ridge spacing only for a portion of the wave guide and with the effect of plug spacing (with constant ridge spacing) for the remaining portion of the wave guide.

Where a minimum standing wave ratio and a minimum length of wave guide are not overly important, the aforementioned analysis is unnecessary, and an exponential taper is entirely satisfactory.

The performance of the embodiment shown in the figure is indicative of the merit of the invention. A voltage standing wave ratio of approximately 1.1 was maintained over a 40% band of frequencies.

It will be apparent that there may be deviations from the invention as described which still fall fairly within the spirit and scope of the invention.

Accordingly all such deviations are claimed which fall fairly within the spirit and scope of the invention as identified in the hereinafter appended claims.

What is claimed is:

1. A radio frequency power dissipating load including a rectangular wave guide, two poorly conducting metallic ridges disposed longitudinally and opposite one another within said wave guide, and in contact with the opposite broad sides of said wave guide, and two tapered poorly conducting metallic plugs extending longitudinally within said wave guide and in contact with the narrow walls of said wave guide.

2. A radio frequency power dissipating load comprising a wave guide having a coupling end to which said power is applied, a pair of poorly conducting metallic ridges disposed longitudinally within said wave guide, said ridges being respectively in contact with opposite sides of said wave guide and tapering toward each other at their opposed faces for a portion of their length nearest said coupling end, and two poorly conducting metallic plugs respectively disposed longitudinally in said wave guide and straddling

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said ridges at portions of said ridges other than said tapered portions, said plugs being respectively in contact with the opposite sides of said wave guide and tapering toward each other at their opposed faces a portion of their length from their ends nearest said coupling end.

3. A radio frequency power dissipating load comprising a rectangular wave guide having a coupling end to which said power is applied, two spaced, ferrous metal ridges disposed longitudinally within said wave guide, said ridges being respectively in contact with the opposite broader sides of said wave guide and tapering toward each other at their opposed faces from their end nearest said coupling end for a portion of their length, and two ferrous metal plugs respectively disposed on the opposite narrower sides of said wave guide and straddling said ridges, said plugs tapering toward each other at their opposed faces from their ends nearest said coupling end for a portion of their length.

4. A radio frequency power dissipating load as set forth in claim 3, wherein said ridges and plugs are made of steel.

5. A radio frequency power dissipating load as set forth in claim 3, wherein the taper of said ridges and said plugs is such that the per cent change in impedance per unit of electrical length of said wave guide is a constant, whereby the standing wave ratio becomes a minimum.

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