X-BAND ROTARY JOINT

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INTRODUCTION

In view of the important part played by rotary joints in many radar systems, it is surprising that little or nothing has been published on this subject since the appearance of the discussion by Niemann, Ehlers and Worrell, in which they give the war time status of this component. In spite of the excellent work already done on this project, however, there remained a need for a high power rotary joint with a lower V.S.W.R. over a 11% frequency band.

DESCRIPTION OF ROTARY JOINT

At the outset, it was decided that a door knob transition to coaxial line had the best prospects of meeting the severe requirements of a V.S.W.R. $\leq$ 1.02 over the above band. However in order to avoid the critical dimensions referred to by Niemann, it was decided to taper up to a door knob in such a way as to make a tapered ridge guide arrangement of the transition.

Early design plans called for a Tchebyscheff taper on the basis of characteristic impedance calculations for ridged waveguide. Preliminary measurements convinced us however, that the transition from the coaxial line to the ridged guide was not at all approximated by any simple equivalent circuit, at least with the accuracy required by our specifications. Accordingly the problem was attacked on an emperical basis in two steps. In the first, a good match was achieved between the ridge and the coax, and in the second the waveguide was matched to the ridge by means of a short taper. The low V.S.W.R.'s shown in Figure 1 for the waveguide to coaxial transition shown in Figure 2 are thus the result of perseverance rather than ingenuity. The second transition contained both the chokes for the inner and outer conductors of the coaxial line. These were designed on the basis of elementary considerations and required only minor changes in parameters in order to meet the requirement of a V.S.W.R. $\leq$ 1.02.

When the two transitions were assembled so that 3.5" separated the center lines of the waveguides, the V.S.W.R. performance shown in Figure 3 was obtained. The electrical characteristics of this rotary joint were independent of its angular position below $f/f_0 = 1.054$. Above this frequency slight changes in output power of the order of .1 db were observed which were probably due to mechanical misalignment, since they lacked the symmetry which one would associate with higher mode interaction.

Acknowledgments.

We wish to acknowledge the assistance of Mr. T.S. Saad who made the preliminary designs for the coaxial line and ridged line section of the rotary joint and the assistance of Mr. David Klein who made the measurements given in Figures 1 and 3.

References

1. Niemann, F. E. Ehlers and F. T. Worrell, "Motional Joints," Microwave Transmission Circuits, M. I. T. Radiation Laboratory Series, McGraw-Hill, Vol. 9, Chapter 7, pp. 406-455.

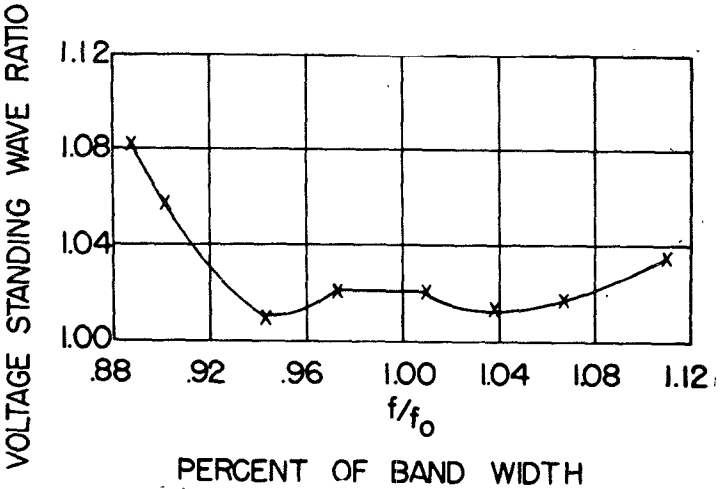

Fig. 1

V. S. W. R. of Coax to Waveguide Transition.

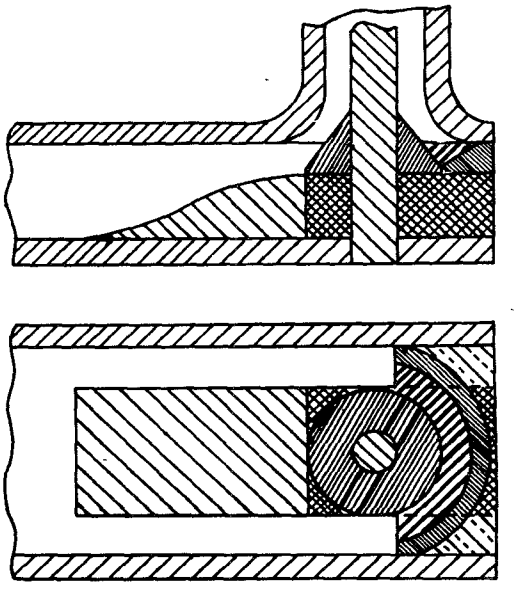

Fig. 2

Sections of Transition.

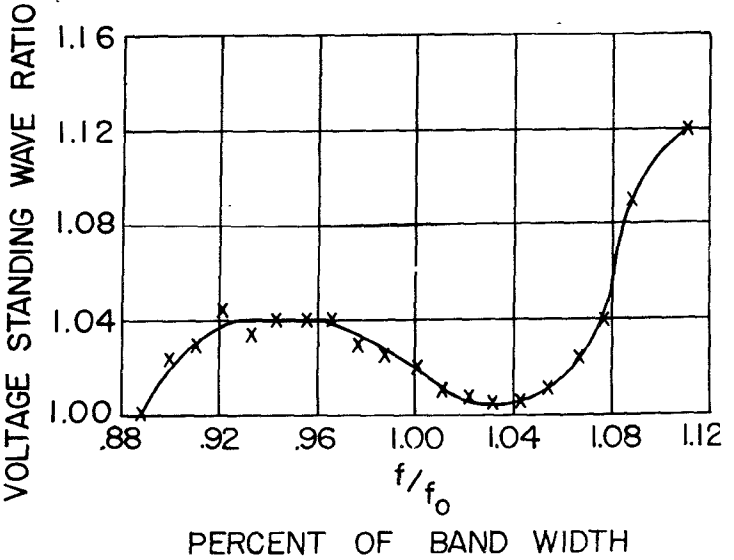

Fig. 3
V. S. W. R. of Rotary Joint.