Abstracts

Some Aspects of Beam Waveguides for Long Distance Transmission at Optical Frequencies

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Two types of beam waveguides are discussed in this paper, the iris-type and the lens-type. Both appear applicable to guided long distance transmission of light with theoretical losses of less than 1 db/km. However, there are problems concerning their practicability which require experimental investigation. Such problems are the alignment of the irises or the lenses, the effects of turbulence and stratification of air along the light path, and the required tolerance in the construction of the lenses. Since the lens-type guide offers a simple possibility for compensating misalignments, an experimental waveguide of this type has been constructed, having a length of approximately 1 km and comprising 10 iterations. The light path is enclosed by a 4 inch aluminum pipe which is supported within a 6 inch aluminum pipe. The first series of experiments which is reported in this paper indicated that there are no serious alignment problems. However, it was found that the effects of turbulence and air stratification are usually very severe and it appears necessary to provide an evacuated light path to obtain constant transmission conditions. It was also found that the available lenses add considerably higher iteration loss than expected. This increased loss was primarily caused by inadequate surface coating. A theoretical study of beam propagation in a misaligned lens-type guide is included in the Appendix.

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