



Coaxial Amplifier Device (High Power Multi-Beam Coaxial Disk-on-Rod Amplifier)

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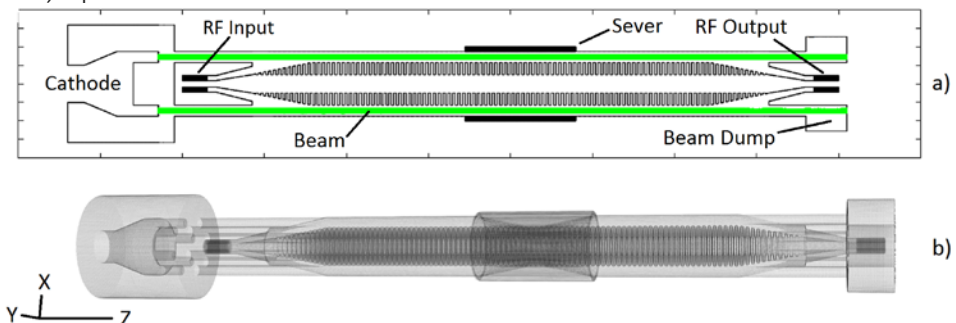
Background:

Amplifiers are a necessary component in a number of RF applications, including radar transmitters, EW systems, and communications. The capabilities offered by a high power, broad band amplifier have significant potential utility in radar applications such as ground-based tracking of space debris.

Technology Description:

The general amplifier configuration is an electron beam driven disk-loaded, or "disk-on-rod," (DoR) coaxial traveling wave tube (TWT). The concept of such an amplifier was originally described by L. M. Field [1], who published on experimental testing of an X-band variant of a coaxial traveling wave tube with disk loading on the center conductor. Further descriptions of the DoR amplifier concept were provided in Field's 1953 U. S. Patent [2]. The center conductor of Field's device was supported by two coaxial couplers, one on the wave injection side and one on the extraction side, on which a TEM wave was injected and extracted, respectively. An annular electron beam, emitted from a thermionic cathode, was used to excite the slow wave structure. The spent beam was impacted on a metallic wall at the extraction end of the tube. Field's tube, as fabricated, had relatively low gain (5 dB) and a maximum output power of approximately around 1.5 Watts [1].

The inventors have developed a novel device configuration to enhance the gain and output power of DoR TWT amplifiers. The invention involves the incorporation of an array of multiple, discrete electron beams which replace the single, annular electron beam originally used by Field [1]. The use of an array of discrete beams to replace the annular electron beam enables better separation of the electron gun from the support points of the DoR slow wave structure (SWS), thus enabling the use of higher voltage electron beams and resulting in higher gain (>15 dB) and higher power (MW-class) operation.



Cross sectional (a) and isometric (b) visualizations of a patent pending high power multi-beam disk-on-rod microwave amplifier.

Key Advantages

- Higher power, higher gain microwave amplification over previous designs.
- Reduced complexity compared to competing high power TWT designs.

[1] L. M. Field, "Some Slow-Wave Structures for Traveling-Wave Tubes", Proceedings of the I. R. E., January 1949.

[2] L. M. Field, "Traveling Wave Tube," U. S. Patent 2,645,737 (14 July 1953).

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