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Authors: R. Lawrence Ives, George Collins, Michael Read, George Miram, David Marsden.

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Abstract: Advanced techniques are allowing fabrication of high frequency RF circuits to high precision. Dimensional tolerances of a few microns are routinely achieved, allowing precise fabrication at frequencies approaching, and sometimes exceeding, 1 THz. Fabrication is usually performed by computer-controlled machines, often without human intervention. A more challenging task, however, is fabrication and assembly of electron guns operating at thousands of volts and temperatures often exceeding 1000°C. Electron gun assembly, especially for thermionic guns, is still primarily a manual process. Because the electron gun operates at a high negative potential, it is necessary to electrically isolate the gun from the RF circuit, requiring one or more bonding processes, which usually include brazing or welding. A further complication is integrating the electron gun and circuit with a magnetic field providing beam confinement. Precise alignment is required to achieve adequate beam transmission. Again, this alignment is typically a manual procedure. This publication identifies the issues associated with the design, fabrication, assembly, and integration of high voltage thermionic electron guns with Terahertz RF circuit and describes simplification provided by the latest generation of high current density cathodes.

Keywords: Cathodes, Reservoir cathodes, Electron guns, Electron beams, RF sources, Terahertz