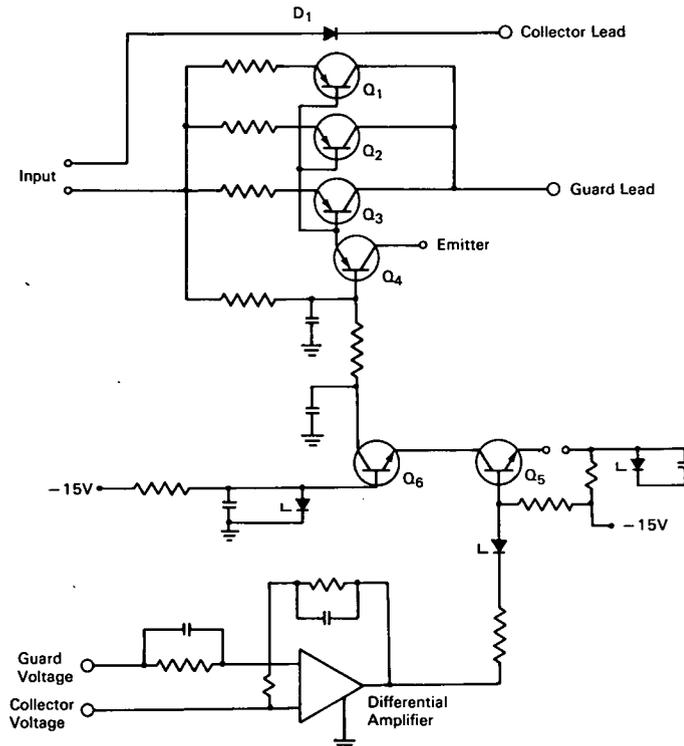


NASA TECH BRIEF



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Collector/Collector Guard Ring Balancing Circuit Eliminates Edge Effects



The problem:

One of the problems in thermionic converters involves the use of plane parallel electrodes. A guarded electrode arrangement is required to eliminate edge effects.

The solution:

A circuit in which an emitter is maintained opposite a concentric collector and guard structure. In this arrangement effective guarding is achieved by matching the temperature and potential of the guard with that of the collector over the operating range.

How it's done:

The three pass transistors, Q_1 , Q_2 , and Q_3 , control voltage drop in the guard lead to balance that in the collector lead. Diode D_1 in the collector circuit ensures that sufficient voltage is maintained across Q_1 , Q_2 , and Q_3 to keep them out of saturation. Q_1 , Q_2 , and Q_3 and D_1 also act to block the reverse current portion of the sweep. These are mounted on a water-cooled heat sink to dissipate the appreciable power involved in their operation. Q_4 is a driver transistor and uses the sweep voltage as a power source. The differential amplifier senses any imbalance at the

(continued overleaf)

voltage leads and, after amplification of Q₅ and the isolation provided by Q₆ (a common base stage), input to the differential amplifier reduces oscillations due to feedback.

Notes:

1. Connected to a converter, balance within 10 mv was obtained except near the ignition point where there were some small oscillations that were not visible on an actual J-V plot. At high currents the system was stable and no oscillations were present.
2. This control system is capable of handling up to 100 amperes in the guard circuit and 200 amperes in the collector circuit.

3. Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, California 91103
Reference: B66-10563

Patent status:

No patent action is contemplated by NASA.

Source: David P. Lieb
of Thermo Electron Engineering Corporation
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