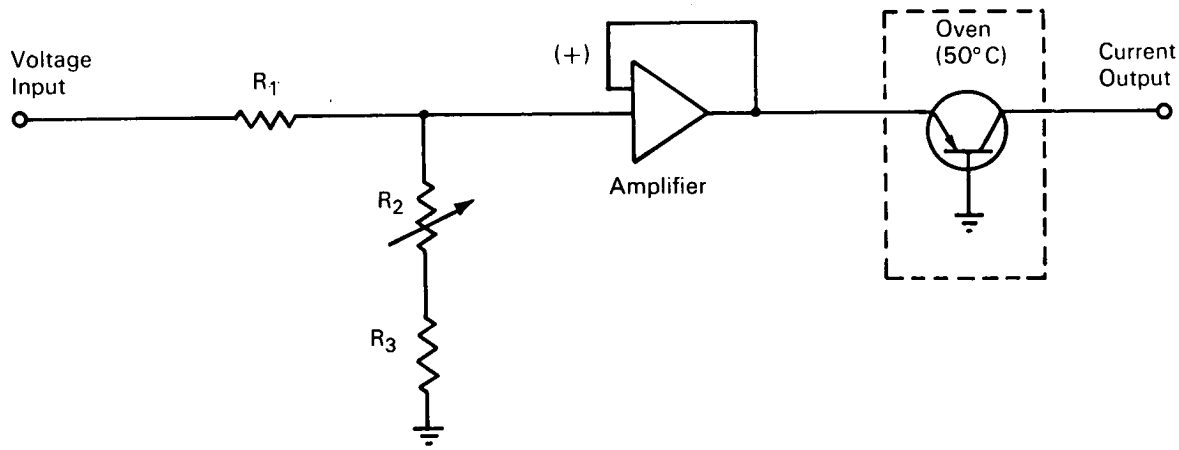
AEC-NASA TECH BRIEF

Microcurrent Generator Produces Electrical Currents Accurately between 10^{-11} Ampere to 10^{-3} Ampere



The problem:

To test low current devices such as ion chambers a current generator was needed to accurately simulate currents in the range of 10^{-11} ampere to 10^{-3} ampere.

The solution:

An electronic circuit design that uses operational amplifiers, current dividers and a transistor such that the current output equals antilog (V_{input}/K), where K is determined by circuit parameters.

How it's done:

The microcurrent generator shown has the required characteristics, i.e., $V_{in} = K \log V_{out}$. The voltage divider (R_2) is used to set the value of K. For this particular circuitry to produce a current change of one decade, the voltage at the output of the operational amplifier must change by approximately 60 millivolts. Stabilizing the transistor by placing it in a a temperature controlled oven at 50°C provides a low current limitation of the circuit of 10^{-10} ampere. The circuit is adjusted so that each time the input voltage changes 2 volts in range, a change in current of one decade is produced. For example: a change from 2 to 4 volts provides a current change of one decade; a change of 2 to 8 volts results in a current change of 3 decades, etc.

Notes:

1. For the circuit shown:

$$I_{out} = 10^{-11} \text{ antilog } (V_{in}/2 + 2)$$

2. Compensation networks have been devised to improve the accuracy at the lower current levels.
3. Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
AEC-NASA Space Nuclear Propulsion Office
U.S. Atomic Energy Commission
Washington, D.C. 20545
Reference: B66-10706

(continued overleaf)

Patent status:

No patent action is contemplated by AEC or NASA.

Source: J. Wilson
of Westinghouse Astronuclear Laboratory
under contract to
AEC–NASA Space Nuclear Propulsion Office
(NU-0087)