Transistor Circuit Increases Range of Logarithmic Current Amplifier

The problem:
To design a logarithmic current amplifier capable of operating throughout a range of $10^{-12}$ to $10^{-2}$ amperes. Amplification through this range can be obtained by cascading amplifiers in incremental steps but this creates problems of physical volume, reliability, calibration, and difficult operation.

The solution:
A circuit that provides logarithmic amplification of an input range from $10^{-12}$ to $10^{-2}$ amperes by combining a commercially available amplifier with a silicon epitaxial transistor.

How it's done:
The principle of operation involves the placement of a logarithmic feedback element across the amplifier. The circuit operates on the transfer function of the silicon epitaxial transistor, $Q_1$ in which the output voltage is proportional to the log of the input current. Resistors $R_1$ and $R_2$ and the capacitor stabilize the circuit. That portion of the circuit within the dotted lines serves only to provide temperature compensation for $Q_1$. Input impedance is 10 megohms and input signal strength is $10^{-12}$ to $10^{-2}$ amperes.
Note:
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
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No patent action is contemplated by NASA.
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