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NASA TECH BRIEF

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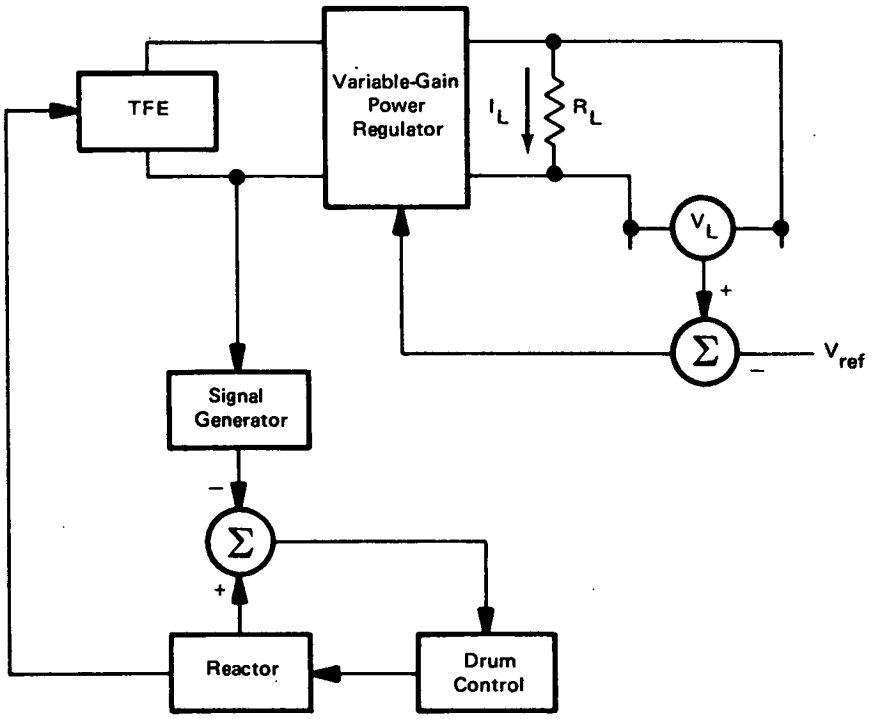
Improved Control for Nuclear/Thermionic Power Source: A Concept



Proposed Feedback Model for Thermionic/Nuclear Power Source

Nuclear/thermionic reactors used for the generation of electrical power operate from a set of electrical converters, or thermionic fuel elements (TFE's). Each converter is cylindrical in shape and functions as a thermionic diode. Most of the converter volume is filled with nuclear fuel which is enclosed by a cylindrical emitter. A cylindrical collector is spaced radially around the emitter.

When the nuclear fuel heats the emitter, thermal emission is generated, producing electrical power. This power output must be controlled to maintain a constant load voltage. Several controls have been considered, yet none eliminates the transient load-voltage variations that result from varying loads.

A new control method has been proposed in which a variable-gain power regulator is used to maintain constant load voltage, as shown in the illustration. Basically, there are two feedback loops. One is tied directly with the regulator to feed the error voltage, which is the sum of the reference and load voltages.

The second loop is tied with the reactor, where the output current of the TFE's is fed back to a signal generator. Signals from the generator and the reactor are summed and fed to the reactor drum control. If there is a sudden change in the output current level, the drum control receives the error signal and commands the reactor to increase or decrease the neutron output to the thermionic fuel element. Since the neutron levels

(continued overleaf)

are changed instantaneously, the temperature of the thermionic emitter remains practically constant. As a result, constant voltage control and constant emitter-temperature control are provided at the same time.

Notes:

1. The proposed control may be of interest to manufacturers of nuclear reactors and to utility companies.
2. Requests for further information may be directed to:

   Technology Utilization Officer
   NASA Pasadena Office
   4800 Oak Grove Drive
   Pasadena, California 91103
   Reference: B74-10167

Patent status:

This invention is owned by NASA and a patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

Patent Counsel
NASA Pasadena Office
4800 Oak Grove Drive
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