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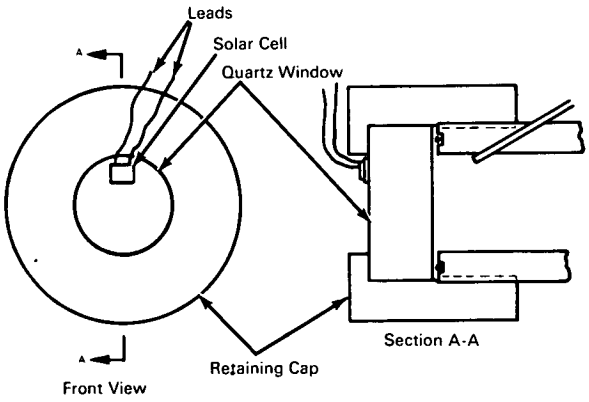
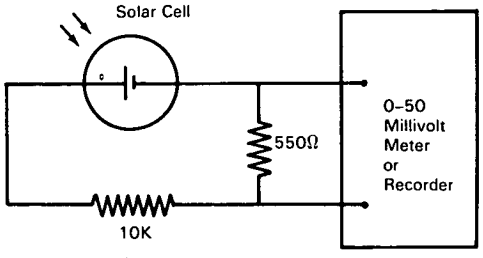
Silicon Solar Cell Monitors High Temperature Furnace Operation



INSTALLATION OF SILICON SOLAR CELL



RECORDING CIRCUIT

The problem:

To continuously monitor a furnace operating at high temperatures and pressures without interfering with the test assembly or optical pyrometry during the test, and at lowest possible cost.

The solution:

Attach a small silicon solar cell to each viewport to monitor the incandescent emission (which is a function of temperature) from the hot interior of the furnace. This technique can provide continuous indication of hot spots or provide warning of excessive temperatures in cooler regions. Since silicon solar cells are self-generating, they can be connected directly to a calibrated meter or used as the control signal source for an alarm system. Normal optical pyrometry is still possible for higher accuracy measurements.

How it's done:

Silicon solar cells 0.2 inch x 0.2 inch are cemented directly to the pyrex or quartz sight ports, using a clear epoxy. The cells are located on the ports to receive direct radiant emission from the hot body. Because of the small size of the solar cells it is possible, on a half-inch diameter or larger sight port, to view the same body with a conventional optical pyrometer while the solar cell is installed. This permits direct individual calibration if required. The output of the solar cell is connected directly to a voltmeter, recorder, or alarm system. Solar cells thus installed on a high-temperature thermocouple test furnace have been found to operate within a +2% band over a temperature range from 2200° to 4800° R.

Notes:

1. The overall cost of a solar cell/voltmeter unit is under $50 (cells cost under $2.00).
2. Thermocouples capable of operating over the same range with similar accuracy would cost between $500 and $1000 each, and would possibly affect test assembly geometry. Readout equipment would be an additional cost.
3. Automatic optical pyrometers for this temperature range cost approximately $5000 each.

(continued overleaf)

4. 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: B68-10148

Patent status:

No patent action is contemplated by AEC or NASA.

Source: G. J. Zellner
of Westinghouse Astronuclear Laboratory
under contract to
AEC-NASA Space Nuclear Propulsion Office
(NUC-10163)