NASA TECH BRIEF

Lyndon B. Johnson Space Center

Ultraviolet Hydrogen-Discharge Lamp

The problem:

Conventional hydrogen arc lamps are often used in the calibration of ultraviolet sensing instruments. The problem with these lamps, however, is that their outputs have large variations in intensity. Such instabilities prevent proper intensity calibration.

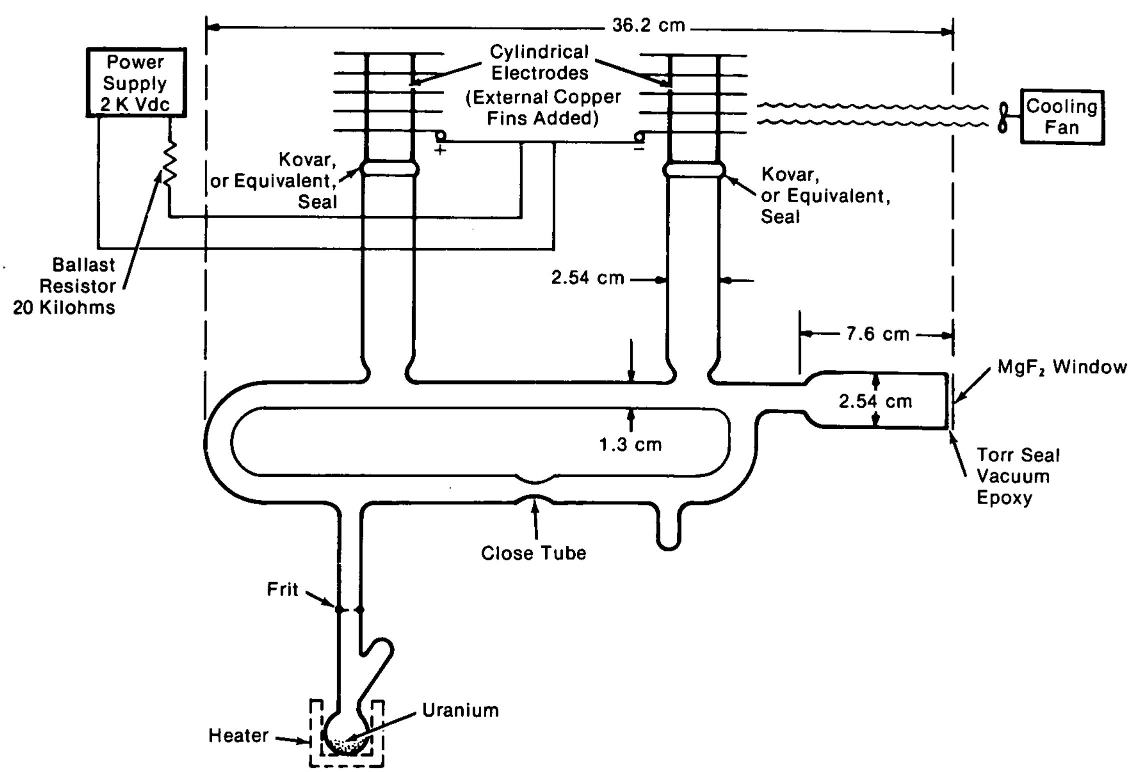
The solution:

A stable flux output can be obtained from a newly-developed hydrogen-discharge lamp. The lamp generates an ultraviolet spectrum ranging from 1,175 to 1,700 Å and is stable enough for accurate intensity calibration.

How it's done:

The key lamp elements are uranium, uranium hydride, and hydrogen gas. Uranium provides two important features necessary for stable ultraviolet output:

1. Finely-ground uranium particles serve as a powerful getter for all gases, except the rare ones, encountered in spectroscopic light sources.
2. Uranium readily forms compounds with most elements that have suitable thermodynamic properties (such as hydride, oxide, nitride, and others). For example, uranium hydride, UH_3, can be formed and associated reversibly to yield equilibrium hydrogen pressures useful in discharge light source.



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(continued overleaf)

The basic lamp configuration as shown includes pure metal uranium mixed 50/50 with UH_3. The mixture is contained in a spherical bulb surrounded by an electrically-controlled heater circuit. This mixture is obtained by careful regulation of hydrogen pressure and temperature during fabrication. Metal uranium is exposed to H_2 until the proper 50/50 proportion is obtained.

The heater circuit surrounding the spherical bulb controls the temperature within ±1° C with a feedback circuit. The feedback includes a thermistor temperature sensor which is in direct contact with the bulb. Typical equilibrium temperature of the lamp is 190° C with a hydrogen pressure of 0.36 torr, although stable operation can be obtained for different values of pressure and current. Lamp current is generated by a 2-kV dc power supply. The supply is accurate to within ±0.05 percent. The resulting ultraviolet output is viewed through a MgF_2 window.

Test results indicate that the lamp operating at 60 mA, and the bulb temperature set at 190° C, gives a rich spectrum of molecular hydrogen and a strong Lyman *a* at 1,216 Å, the latter with some self-reversal. A spectrum search between 1,200 and 1,700 Å indicates no traces of impurities. The lamp output is very stable: the intensity varies only to within 1 percent/hour.

Notes:

1. The lamp is described in the following report:
   Final Report for Apollo 17 Ultraviolet Spectrometer Experiment (S-169)
   NASA CR-140316 (N75-10128)
   A copy of this report may be obtained at cost from:
   Technology Application Center
   University of New Mexico
   Albuquerque, New Mexico 87131
   Telephone: 505-277-3622
   Reference: B75-10272
2. Specific technical questions may be directed to:
   Technology Utilization Officer
   Johnson Space Center
   Code AT3
   Houston, Texas 77058
   Reference: B75-10272

Patent status:

NASA has decided not to apply for a patent.

Source: D. E. Kerr of
Johns Hopkins University
(MSC-14793)

Categories: 03 (Physical Sciences)
01 (Electronics - Components and Circuitry)