2.1 Optical-Microwave Section, Figure 3

Light of the pumping wavelength is generated by an electrodeless discharge lamp excited by a vacuum-tube oscillator. The lamp contains natural rubidium and krypton at a pressure of a few torr. The spectral characteristics of the light from the discharge lamp are modified by a filter cell placed in the optical path. The filter cell contains rubidium-85 and 30 to 50 torr of argon or neon. The entire lamp and filter cell assembly was built for the National Bureau of Standards by Varian Associates. The spectral characteristic of the pumping light is further modified by an interference filter which passes the D-2 rubidium line at 7800 A but not the D-1 line at 7947 A. The interference filter is used because the shift in frequency with light intensity for these standards was found to be less for the D-2 than for the D-1 line.

The rubidium vapor in which the transition is to be observed is located in a TE 0 1 1 cylindrical microwave cavity which is resonant at 6.83 GHz. Due to the mode of resonance in the cavity, large openings are possible in the end faces and are used to admit the pumping light and pass the transmitted light on to the photocell. The rubidium vapor at a pressure of about 10^{-6} torr and a buffer gas mixture at a total pressure of about 39.6 torr are contained in a quartz cell. The mixture is approximately 49.1% nitrogen and 50.9% methane, which gives maximum frequency at about 45°C. The frequency falls off quadratically above and below this point with a 2×10^{-11} deviation at ± 2°C from the peak frequency temperature. After passing through the gas cell, light is focused on a silicon photo-voltaic cell by a Fresnel lens.