Calibration

The quantity k_r/k is the ratio of the "radiation conductivity" to the gas conductivity, and has a value of 0.03 or less. Therefore, (1) converges rapidly. Since k_r is a constant at a particular temperature, (1) may be rewritten

$$\frac{\Delta T}{q} = \sum_{i=0}^{\infty} c_i \, k^{-i}, \qquad (3)$$

where the c_i are constants.

In order to calibrate the cell, the quantity $\Delta T/q$ is measured for gases of known thermal conductivity. By regression analysis, the coefficients are obtained up to the eighth order, and the order is chosen which has the lowest percentage standard error of estimate, S, as defined by

$$S = \left[\sum_{i=1}^{n} \left(\frac{\left(\frac{\Delta T}{q}\right)_{ci} - \left(\frac{\Delta T}{q}\right)_i}{\left(\frac{\Delta T}{q}\right)_i} \right)^2 \Big/ (N - n - 1) \right]^{1/2} \times 100 \qquad (4)$$

Since the relative precision of the measurements was approximately constant, the data was weighted by the factor $(q/\Delta T)^2$.

With the constants for equation (3) known, values of $\Delta T/q$ for gases of unknown thermal conductivity may be measured, and equation (3) solved by an iterative technique to yield the thermal conductivity of the sample. These calculations were easily performed on a digital computer.