From (12) and (13) we obtain the other required coefficient:

$$\frac{d^2\mathbf{q}}{dx^2} = -\frac{12\bar{\mathbf{q}}}{d^2}. \tag{33}$$

The work of Khalatnikov (*8*) has indicated that the bulk viscosity may be of the order of ten times the ordinary viscosity, so in estimating an upper limit on R_1 we consider the viscosity term to be $^{1}\!/_{12}$. Also, the maximum value of $\mathbf{q}$ is $^{3}\!/_{2}\bar{\mathbf{q}}$. Substituting (30) and (33) into (28) we obtain an expression for R_1 in terms of known or calculable quantities. For $d = 2\mu$ and the maximum $\mathbf{q}$'s encountered in these experiments, Table I presents the maximum value attained by R_1 at several temperatures, from which it is seen that in these experiments $R_1 \ll 1$.

The ratio of the pressure gradients R_p across the slit to those along it may be found from (9) and (10), neglecting the small second term in (9).

$$R_p = \frac{\partial P/\partial x}{\partial P/\partial z} = \left(\frac{\eta_n + \eta'}{\eta_n}\right)\frac{(d\mathbf{q}/dx)(d\beta/dz)}{\beta(d^2\mathbf{q}/dx^2)} \tag{34}$$

Estimates of the maximum values of R_p are also given in Table I and indicate that except for the largest heat flows in the vicinity of the λ-point the pressure gradient across the slit is negligible compared to that along the slit. By virtue of the relation (16) between ∇P and ∇T the same statement may be made for the temperature gradient, indicating the extent of validity for the assumption made in (8) that T is a function of z alone.

The second order terms in (1) and (2) may be shown to be small in the same way. We are concerned with gradients of the energy in the z direction. In (2) we compare the z component of the left hand side with the z component of ∇P:

$$R_E = \frac{\rho_n[\partial(v_n^2/2)/\partial z]}{(\rho_n/\rho)\partial P/\partial z} = \frac{\rho(d/dz)(\beta^2\bar{\mathbf{q}}^2)}{(24\eta_n\bar{\mathbf{q}})/(\rho s T d^2)}. \tag{35}$$

Since

$$\begin{aligned} \beta^2 &= \beta_\lambda^2\zeta^{-2(n+1)}, \\ R_E &\sim (n+1)\rho\beta^3\bar{\mathbf{q}}^2(1 + \alpha d^2\bar{\mathbf{q}}^2). \end{aligned} \tag{36}$$

TABLE I

Maximum Values of the Ratios R_1, R_p, and R_E Corresponding to the Maximum Heat Current Density $\bar{\mathbf{q}}_{max}$ at Several Temperatures for Slit *I* ($d = 2\,\mu$), $T_0 = 1.1$°K

T(°K)	Λ (watt/cm³ − deg)	α (cm²/watt²)	$\bar{\mathbf{q}}$ (watt/cm²)	R_1	R_p	R_E
1.2	3×10^6	6.9×10^5	10^{-1}	$<10^{-4}$	4×10^{-3}	10^{-3}
1.8	7.3×10^8	5.2×10^5	10	$<10^{-5}$	4×10^{-3}	9×10^{-3}
2.15	3.5×10^9	3.3×10^7	15	$<10^{-6}$	$<10^{-1}$	3×10^{-2}