Using the experimental values of $\bar{\mathbf{q}}_{\max}$ we find values of R_E given in Table I which indicate that it is reasonable to neglect the second order terms in the calculations of heat flow and fountain pressure.

In obtaining (6) and (25) two assumptions concerning the flow of heat have been made. The first is that conduction of heat by the ordinary diffusive mechanism is small compared to the conduction by the counterflow mechanism. That this is so may be easily verified by considering the results of Zinovieva (*10*) for the ordinary heat conductivity coefficient; when these are applied to the experimental conditions of I and II the amount of heat carried by the normal diffusive process is found to be several orders of magnitude smaller than that transported by the convection process, even at the largest ΔT's.

The second assumption we have made is that the kinetic energy associated with the flow is small compared to the heat flow by internal convection. The heat introduced by the heater at the hot end of the slit will be conveyed as kinetic energy of flow as well as by normal fluid convection. The total heat supplied by the heater then becomes

$$\bar{\mathbf{q}} = \rho s T \bar{\mathbf{v}}_n + \tfrac{1}{2}\rho_n v_n^2 \bar{\mathbf{v}}_n + \tfrac{1}{2}\rho_s v_s^2 \bar{\mathbf{v}}_s \,. \tag{37}$$

Making use of the vanishing of momentum and defining $\mathbf{q}_i(z)$ as the heat current due to internal convection at any point z in the slit, i.e., $\mathbf{q}_i(z) = \rho s T \mathbf{v}_n$, we have

$$\bar{\mathbf{q}} = \bar{\mathbf{q}}_i(z)\left[1 + \frac{\rho_n(\rho_n^2 - \rho_s^2)}{2\rho_s^2(\rho s T)}\left(\frac{\bar{\mathbf{q}}_i(z)}{\rho s T}\right)^2\right]. \tag{38}$$

The second term in this expression is small for temperatures above 1.1°K and for the heat currents employed in the experiments under discussion, except in the region very close to the λ-point. At 1.2°K the maximum value of this term is of the order -10^{-6}; at about 1.97°K where $\rho_s = \rho_n$ it is of course zero; and even at 2.1°K it is no more than 10^{-4}. Thus kinetic energy terms cannot appreciably alter the heat flow through the slits.

The final point to be discussed in this section is the influence upon the heat flow of the heat generated by viscous forces through shear. According to the two fluid model the normal fluid behaves as a truly classical fluid with a classical viscosity. The heat generated per unit volume per second by shear may be expressed using the Rayleigh dissipation function Φ in the form used by London (*20*)

$$\Phi = \frac{\eta_n}{2}\sum_{ik}\left(\frac{\partial v_{ni}}{\partial x_k} + \frac{\partial v_{nk}}{\partial x_i}\right)^2 + \eta'(\nabla\cdot\mathbf{v}_n)^2. \tag{39}$$

Using the approximations and assumptions made previously, the dominant term is $\eta_n(\partial v_{nz}/\partial x)^2$. With (20) and (5) Eq. (39) becomes upon averaging across