-4. The frictional term acts only
eds $\mathbf{v}_c$.
ormal fluid in obtaining (12) re-
normal fluid velocity vanish at the
onsidered to possess no viscosity no
must resort to other arguments to
sufficient condition for this profile
bitrarily small force, a function of
l the normal fluid. The form of the
g a nonvanishing force and neglect-

$$- (\rho_s/\rho)\nabla P. \quad (16)$$

$\mathbf{v}_n$ in the form

$$, P). \quad (17)$$

of the earlier assumptions (justified
ligible variation across the slit.

$$\int_{-d/2}^{d/2} f(T, P)\, dx = f(T, P). \quad (18)$$

$$- \mathbf{v}_n . \quad (19)$$

rom (12) using $\mathbf{q} = \beta^{-1}\mathbf{v}_n$) by

$$\frac{4x^2}{d^2}\Big) \quad (20)$$

profile is

$$\frac{x^2}{d^2}\Big) - \frac{\rho}{\rho_s}\Big] \quad (21)$$

is

$$/\rho_s)\bar{\mathbf{v}}_n . \quad (22)$$

f the velocity being given by

$$d^2)\bar{\mathbf{v}}_n\mathbf{e}_y . \quad (23)$$

nd the circulation is a maximum at

a frictional force exists between the

normal and superfluid. A force of the form (15) vanishes for sufficiently small velocities, and for these low velocities further discussion of the superfluid velocity profile is required. Since the superfluid probably flows entirely without dissipation the most likely flow pattern is one without circulation. This would mean that the velocity is constant across the slit. However, there is no experimental evidence supporting this idea, and as we have just shown even a vanishingly small force is sufficient to produce the profile of (21). The situation is analogous to that which occurs in the flow of fluids about airfoils. The solution for the case of vanishingly small viscosity is qualitatively different from that obtained when the viscosity vanishes identically. For identically zero viscosity circulation cannot be established and zero lift is obtained. For vanishingly small viscosity the Kutta boundary condition on the flow applies, and classical lift occurs. It has been shown that for the flow of pure superfluid He II about an airfoil the lift vanishes at low velocities *(9)*, and that therefore in subcritical superfluid flow the viscosity is identically zero. It seems probably that a similar situation obtains in the present case and that at sufficiently low relative velocities the frictional force should vanish identically, the superfluid flow being then truly irrotational. It is of interest to note that, could the superfluid velocity profile be measured in a slit at low velocities, one might determine unequivocally, purely from the qualitative character of the flow, whether this is indeed the case.

The z component of (16) is given by

$$\rho_s\, s\, \frac{\partial T}{\partial z} = \frac{\rho_s}{\rho}\frac{\partial P}{\partial z} + A\rho_s\,\rho_n(|\,\mathbf{v}_s - \mathbf{v}_n\,| - \mathbf{v}_c)^{m-1}(\mathbf{v}_s - \mathbf{v}_n). \quad (24)$$

Using (19) to replace $(\mathbf{v}_s - \mathbf{v}_n)$ by $\overline{\mathbf{v}_s - \mathbf{v}_n}$ and converting velocity into heat current density with (3) and (5) we obtain from (13) and (24) with $m = 3$

$$\frac{\partial T}{\partial z} = -d^{-2}\Lambda^{-1}\bar{\mathbf{q}}[1 + \alpha d^2(\bar{\mathbf{q}} - \mathbf{q}_c)^2] \quad (25)$$

where

$$(\bar{\mathbf{q}} - \mathbf{q}_c) = 0 \qquad \bar{\mathbf{q}} < \mathbf{q}_c , \qquad \mathbf{q}_c \equiv \rho_s s T \bar{\mathbf{v}}_c ,$$

$$\Lambda = \frac{(\rho s)^2 T}{12\eta_n}$$

and

$$\alpha = \frac{A(\rho_n/\rho)}{12\eta_n(\rho_s/\rho)^3 s^2 T^2} .$$

For all but the smallest temperature differences (25) must be integrated to obtain $\bar{\mathbf{q}}$ as a function of ΔT between the slit ends. When this is done we have