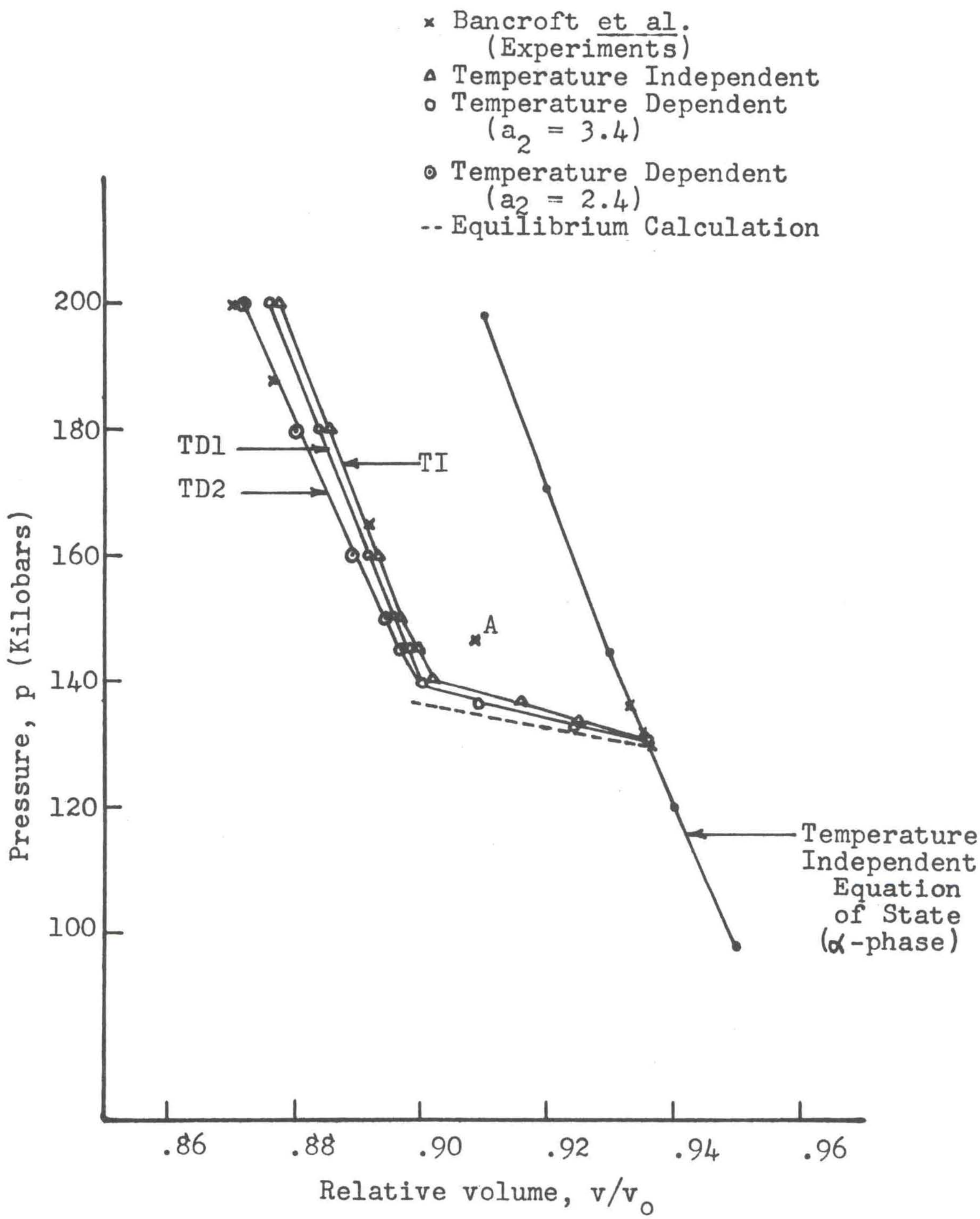

Fig. 5.16.--The Hugoniot Curve in and beyond the Coexistence Region.

5.32 Permanent Regime

After the shock of the last section has propagated far into the medium, the profiles of the first and second shocks are expected to become unchanging, though they continue to separate because of differing velocities. When this happens, these profiles should be described by a permanent regime solution to the flow equations (37). Such a solution is obtained here in order to determine how far the wave must travel to closely approach the permanent regime and to provide an independent check on the numerical integration for the transient case. We proceed by setting $(\partial/\partial t)x = 0$ for all variables in Eqs. (3.3)-(3.5) and (3.43). The resulting equations are, for the temperature independent case:

$$\rho u \, du/dx = -dp/dx \tag{5.15}$$

$$d(\rho u)/dx = 0; \; \rho u = m \tag{5.16}$$

$$u d\alpha/dx = (\alpha^{eq}-\alpha)/\tau \tag{5.17}$$

$$v = v_1 + (v_2-v_1)\alpha \tag{5.18}$$

$$v_2(p) - v_1(p) = \text{const} \tag{5.19}$$

$$p = p(v_1) \tag{5.20}$$

Combining Eqs. (5.16) and (5.15) yields the Earnshaw relation:

$$p-p_o = \rho_o^2 U^2 (v_o-v) = m^2(v_o-v) \tag{5.21}$$

where U is shock velocity. Combining Eqs. (5.17), (5.18), (5.19) and (5.21) yields an equation for dp/dx in the transition region

$$dp/dx = m (v_1-v_2)(\alpha^{eq}-\alpha)/\tau(1+m^2dv_1/dp)v \, . \tag{5.22}$$