EQUATION OF STATE

The equation of state used by Bridgman to represent compression data is

$$-\frac{\Delta V}{V_0} = a_v P - b_v P^2 \tag{8}$$

where coefficients a_v and b_v are functions of temperature only. Successive differentiation of equation (8) yields a_v and b_v as functions of the isothermal bulk modulus and its pressure derivative:

$$a_v = \frac{1}{B_T} \tag{9}$$

and

$$b_v = \frac{1}{2B_T^2}\left(\frac{dB_T}{dP} + 1\right) \tag{10}$$

where all quantities are evaluated at zero pressure. Using equations (9) and (10), the ultrasonic experiments give the following coefficients for tantalum:

$$a_v = 0.526\ (10^{-3}\ \text{kbar}^{-1})$$

and

$$b_v = 0.581\ (10^{-6}\ \text{kbar}^{-2}).$$

The zero pressure compressibility, a_v, like the elastic constants published by Featherston and Neighbours[2], is known within 1 per cent while b_v is about 5.2 per cent uncertain as determined by propagation of maximum errors.

The ultrasonic equation of state is compared in Fig. 2 with the 1949, 30 kbar, relative compression data of Bridgman[15]. This plot