dependence of ρ_i to the temperature dependence of ρ_i. Of course, this again involves the pressure dependence of θ_R. The relation is

$$\frac{1}{\rho_i}\frac{\mathrm{d}\rho_i}{\mathrm{d}p} = \frac{1}{K}\frac{\mathrm{d}K}{\mathrm{d}p} - \frac{\mathrm{d}\ln\theta_R}{\mathrm{d}p}\left\{1+\frac{\mathrm{d}\ln\rho_i}{\mathrm{d}\ln T}\right\}. \tag{1}$$

By making various simplifying assumptions about the electron behaviour and about the lattice it is possible to find a theoretical form for $f(\theta_R/T)$. Relation (1) between $\mathrm{d}\rho_i/\mathrm{d}p$ and $\mathrm{d}\rho_i/\mathrm{d}T$, however, depends only on the type of functional dependence of ρ_i on T and not on its precise form. It happens that with copper the theoretical form of the temperature dependence of ρ_i is very close to that found by experiment (cf. Kelley 1954) so that it does not matter whether one compares the pressure coefficient of resistivity with the theoretical or the measured values of the temperature coefficient.

To obtain a value of $\mathrm{d}\ln\theta_R/\mathrm{d}p$ we assume that it is the same as the corresponding expression derived from the Grüneisen law of thermal expansion, i.e. we *assume* that $\mathrm{d}\ln\theta_R/\mathrm{d}p = 3\alpha V/C_v$ and is independent of temperature. Here 3α is the volume expansion coefficient, C_v the atomic heat at constant volume and V the atomic volume. In what follows we have taken $\mathrm{d}\ln\theta_R/\mathrm{d}p = 1{\cdot}4\times10^{-6}\,\mathrm{atm}^{-1}$.

To compare this theory with experiment we plot $\frac{3\alpha V}{C_v}\left\{1+\frac{\mathrm{d}\ln\rho_i}{\mathrm{d}\ln T}\right\}$ against T using for convenience the theoretical value of $(1+\mathrm{d}\ln\rho_i/\mathrm{d}\ln T)$* with $\theta_R = 320°\,\mathrm{K}$. On the same graph we show the experimental values $(1/\rho_i)\,\mathrm{d}\rho_i/\mathrm{d}p$ derived from our own measurements and also from those of Bridgman (1917, 1932, 1937). We have made a small correction to Bridgman's results to allow for the change of residual resistance with pressure, the correction being assumed the same as for our sample II which appears to be most directly comparable with Bridgman's specimen.

If all the assumptions which we have made were strictly valid, the experimental and theoretical curves would be separated by a constant amount equal to $(1/K)\,\mathrm{d}K/\mathrm{d}p$. The separation above 100° K is in fact very constant for the different specimens, but too much emphasis should not be placed on this because, strictly, we should compare pressure coefficients all measured at the same volume.† Below 100° K the deviations from the theoretical curve become more marked and might well be attributed to an increase of $(1/\theta_R)/\,\mathrm{d}\theta_R/\mathrm{d}p$ with falling temperature, since deviations from the Grüneisen law of thermal expansion are indeed found at low temperatures (see Figgins, Jones & Riley (1956) for the most recent work). It is also known that copper shows departures from the Bloch–Grüneisen law of electrical resistance at very low temperatures so that in this region the theory is not so valuable as at higher temperatures.

Despite these relatively minor discrepancies it is clear that the main features of the temperature variation of the pressure coefficient are very well accounted for by Grüneisen's theory.

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* The function is tabulated by Grüneisen (1941) in an earlier paper on some aspects of the present problem.

† In that case, presumably, the value of $\mathrm{d}\ln\theta_R/\mathrm{d}p$ would also be altered. These effects and the change of compressibility with temperature have been neglected because they are all relatively small.