for nitrogen peroxide from measurements of wave length in it and in air, for the same note.

Calculation of hypothetical $\frac{d\rho}{dp}$. The value of $\frac{d\rho}{dp}$ may be calculated under the two assumptions made above:

Assumption A.—That the dissociation is so rapid that chemical equilibrium exists at every moment.

Assumption B.—That the dissociation is so slow that no chemical reaction takes place during the changes due to the sound waves.

The values under Assumptions *A* and *B* will be indicated by $\left(\frac{d\rho}{dp}\right)_A$ and $\left(\frac{d\rho}{dp}\right)_B$, respectively. These will be compared with the experimental value $\left(\frac{d\rho}{dp}\right)_{exp.}$ given by equation (1).

For a small adiabatic change of the nitrogen peroxide

$$0 = -h\left(\frac{\partial\alpha}{\partial V}\right)_T dV + \frac{1.359}{42660}p\,dV - h\left(\frac{\partial\alpha}{\partial T}\right)_v dT + (1-\alpha)c''_v dT + 2\alpha c'_v dT$$

$$\therefore \frac{dV}{dT} = \frac{h\left(\frac{\partial\alpha}{\partial T}\right)_v - (1-\alpha)c''_v - 2\alpha c'_v}{\frac{1.359}{42660}p - h\left(\frac{\partial\alpha}{\partial V}\right)_T}. \tag{2}$$

Also

$$(1+\alpha)RT = pV. \tag{3}$$

From (2) and (3), and noting that $\frac{d\rho}{dp} = -\frac{\rho}{V}\frac{dV}{dp}$

$$\frac{d\rho}{dp} = \frac{\rho}{\dfrac{R\left\{T\left(\frac{\partial\alpha}{\partial T}\right)_v + 1 + \alpha\right\}\left\{\frac{1.359}{42660}p - h\left(\frac{\partial\alpha}{\partial V}\right)_T\right\}}{h\left(\frac{\partial\alpha}{\partial T}\right)_v - (1-\alpha)c''_v - 2\alpha c'} + RT\left(\frac{\partial\alpha}{\partial V}\right)_T - p}. \tag{4}$$

Under *Assumption A*, since $K = \frac{4\alpha^2}{V(1-\alpha)}$,

$$\left(\frac{\partial\alpha}{\partial V}\right)_T = \frac{K(1-\alpha)^2}{4(2-\alpha)} = \frac{\alpha^2(1-\alpha)p}{(2-\alpha)RT}.$$