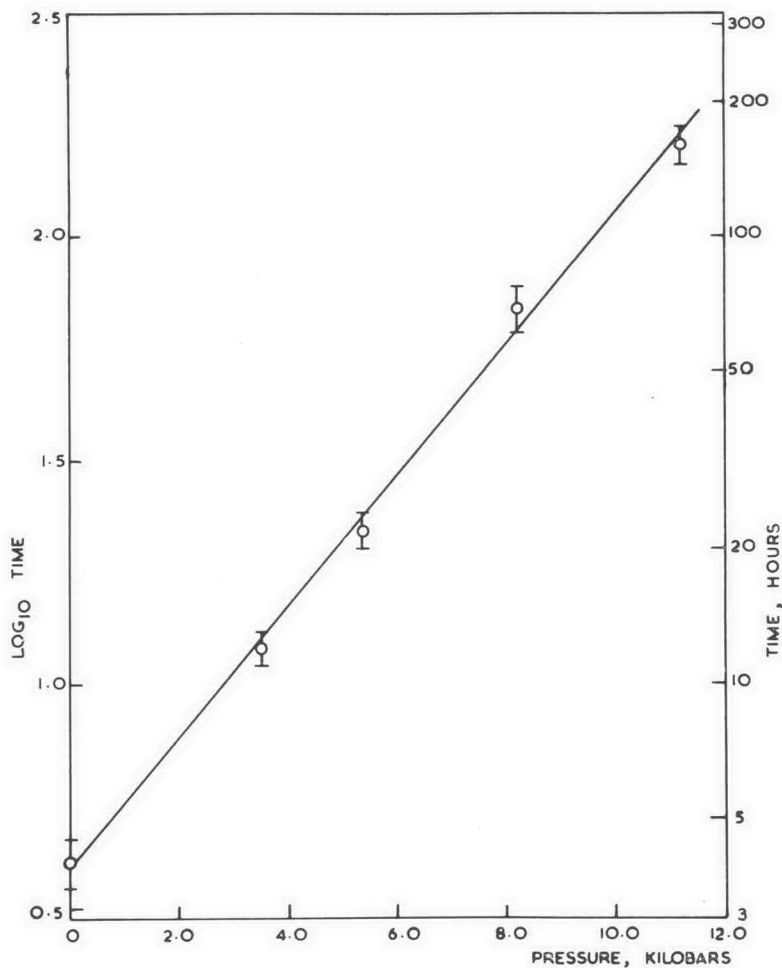


Fig. 4



Variation with pressure of the time required to obtain the standard θ'' result.

where \bar{x}^2 = mean square distance travelled by an atom in time t . Hence, if \bar{x}^2 is a constant, as is assumed in the present experiments:

$$D = \frac{\alpha}{t},$$

where α is a constant. Thus

$$\ln t = \frac{P\Delta V}{RT} + \frac{\Delta U}{RT} + \ln \frac{\alpha}{D_0}.$$

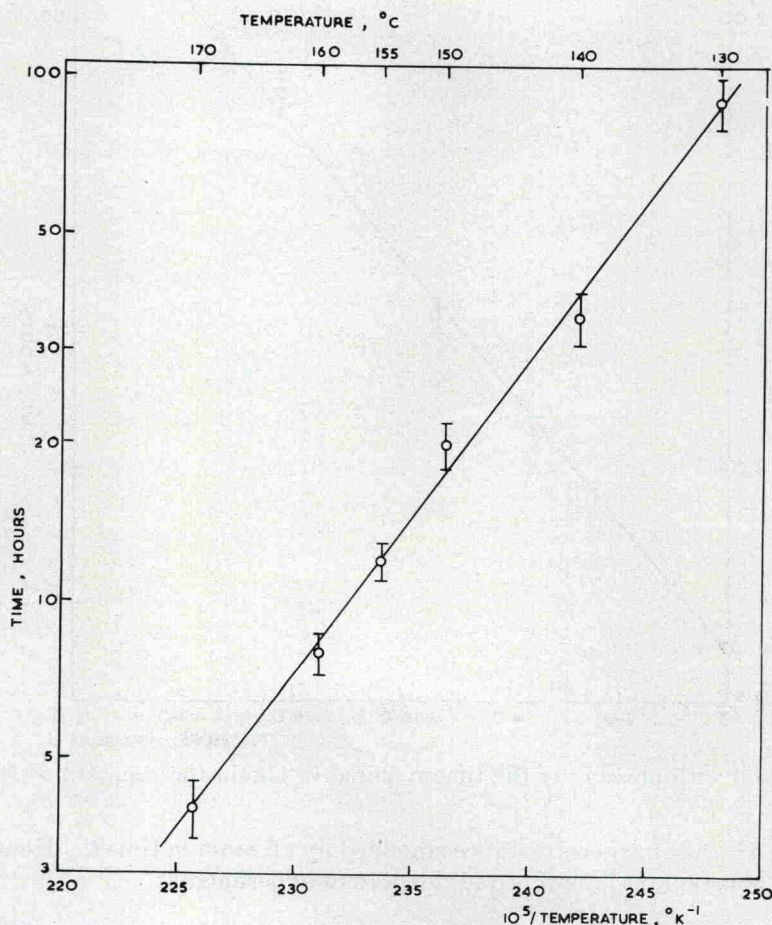
Thus at constant T and if D_0 and ΔU are independent of pressure, then the slope of $\ln t$ versus P will have a gradient of $\Delta V/RT$. From fig. 4 an activation volume ΔV for the diffusion process in the formation of θ'' precipitates

of $12.4 \pm 0.4 \text{ cm}^3 \text{ mole}^{-1}$ is obtained. This can be compared with

$$10.02 \text{ cm}^3 \text{ mole}^{-1},$$

which is the molar volume of aluminium. In work on the effect of pressure on self-diffusion, D_0 is not independent of pressure but the correction to the activation volume due to this factor is less than 10%. For instance, Beyeler and Adda (1968) found that the uncorrected activation volume for vacancies

Fig. 5



Variation with temperature of the time required to obtain the standard θ'' result.

in aluminium was $12.5 \text{ cm}^3 \text{ mole}^{-1}$, and when the correction for the variation of D_0 with pressure was made, the activation volume became $12.9 \text{ cm}^3 \text{ mole}^{-1}$, a correction of less than 4%.

To obtain the apparent activation energy for the formation of the θ'' precipitates, specimens were homogenized at 540°C , quenched to 0°C , aged at room temperature for 24 hr and then further aged at temperatures in