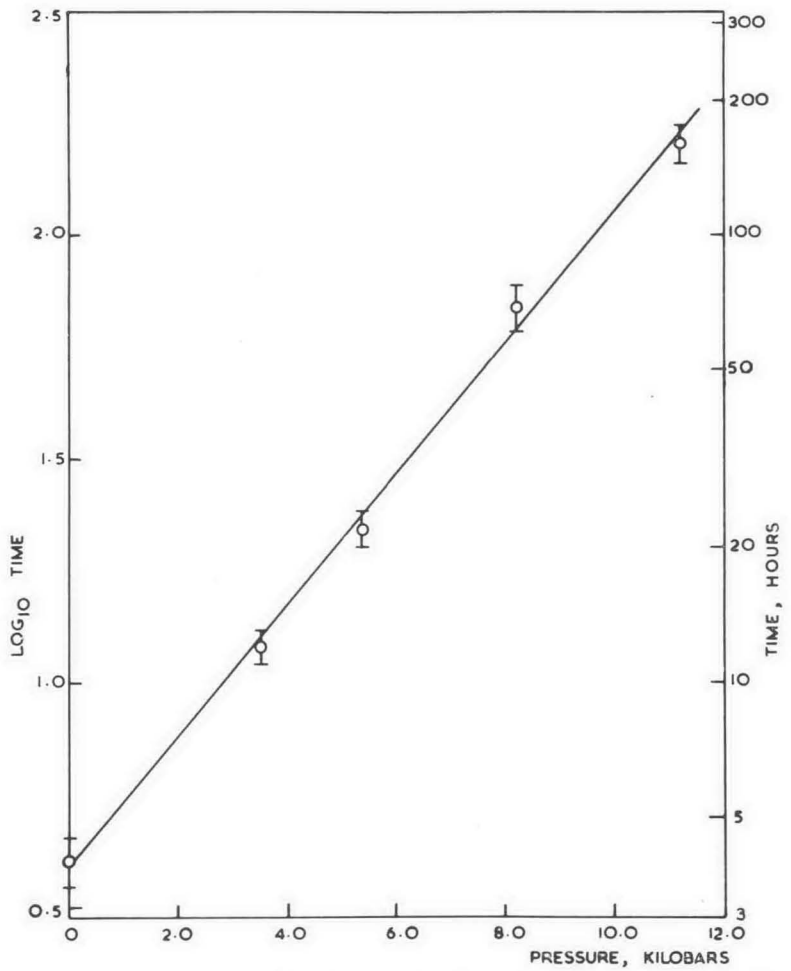
Fig. 4



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

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

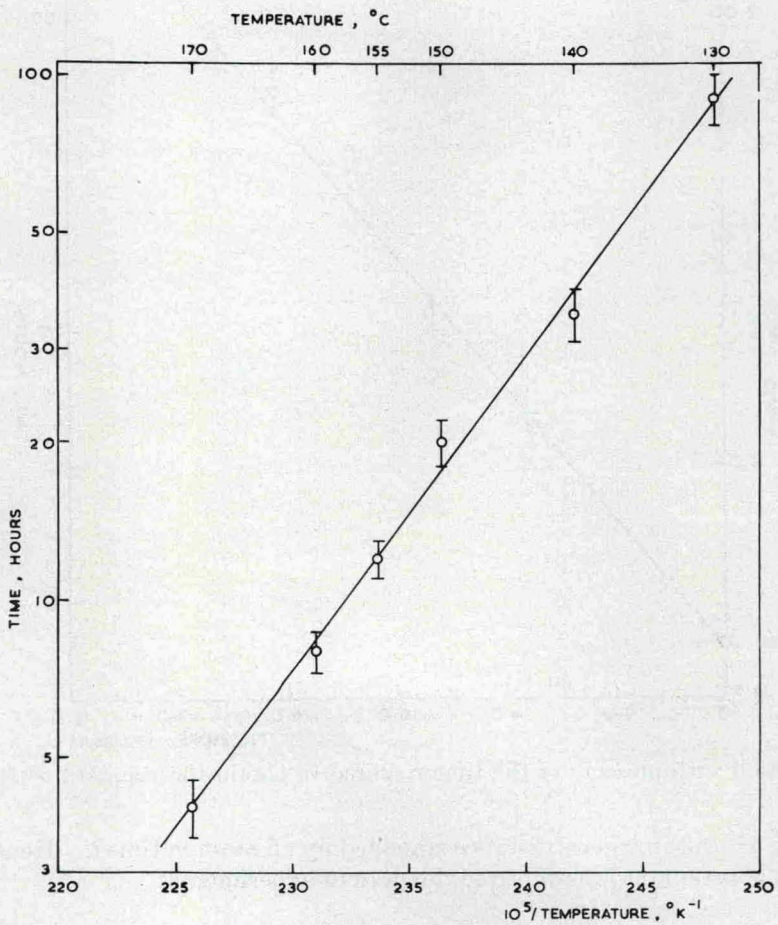
Thus at constant T and if D_0 and ΔV are independent of pressure, then the slope of $\ln t$ versus P will have a gradient of $\Delta V/RT$. From fig. 4 an activation volume ΔV for the diffusion process in the formation of θ'' precipitates

of $12{\cdot}4 \pm 0{\cdot}4\,\mathrm{cm^3\,mole^{-1}}$ is obtained. This can be compared with

$$10{\cdot}02\,\mathrm{cm^3\,mole^{-1}},$$

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 $12{\cdot}5\,\mathrm{cm^3\,mole^{-1}}$, and when the correction for the variation of D_0 with pressure was made, the activation volume became $12{\cdot}9\,\mathrm{cm^3\,mole^{-1}}$, 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