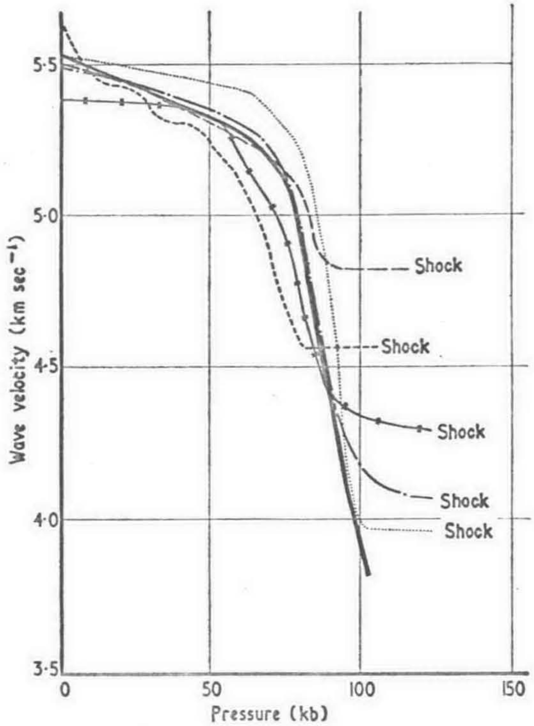

Figure 6. Velocity–pressure curves for simple compression waves in glass, calculated from successive pressure–time profiles such as are shown in figure 5. Round 1 – – – –, round 2 ········, round 3— — —, round 4 —×—×—, round 5 — · — mean ———.

The velocity D of any increment of a compression wave at pressure p and density ρ is given by

$$D^2 = \frac{\partial p}{\partial \rho}. \tag{1}$$

From experiment D is measured as a function of p, $D = g(p)$ say, so that integrating equation (1) gives

$$\rho_1 - \rho_0 = \int_{p_0}^{p_1} \frac{dp}{[g(p)]^2}.$$

This integral can be evaluated numerically to give the pressure as a function of the density

$$p = h(\rho). \tag{2}$$

The particle velocity u can be found by considering the Riemann integral, expressing conservation of momentum

$$\int_{u_0}^{u_1} du = \int_{p_0}^{p_1} \frac{dp}{\rho D}.$$

Using (1) and (2) and putting $u_0 = 0$

$$u_1 = \int_{\rho_0}^{\rho_1} \frac{[h'(\rho)]^{1/2}\, d\rho}{\rho}$$

where the prime represents differentiation with respect to ρ. Therefore from an experimental relationship $D = g(p)$, densities and particle velocities can be evaluated. This