Observations in shock experiments indicate that in some materials stress relaxation or at least some deformation processes continue at a material point until times on the order of a microsecond after shock arrival (Jones, 1970; Barker, 1968). It is possible that the resistance-time structure observed for 1/2 microsecond in the present experiments may result from such processes. A gradual resistance increase after the main shock arrival was observed in unannealed MRC and annealed W3N silver (Fig. A.1). This could be explained by a reduced rate of defect production after the strain rate has decreased from its maximum value.

A gradual decrease in resistance as observed in annealed W3N silver after 1/4 microsecond and in annealed MRC silver for 1/2 microsecond (Fig. A.1) could be explained in terms of point defect annihilation and rearrangement; according to Martin and Paetsch (1973) the resistivity of a cluster of N vacancies or interstitials is given by

$$\rho(N) = \rho(1) \ N^A$$

where A = 0.7 to 0.9 and N < 100.

A problem with such an interpretation is that in 10^{-6} seconds no macroscopic diffusion can take place. Using a diffusion coefficient for silver at one atmosphere D = 1.6 x 10^{10} cm^2/sec (LeClaire, 1949), a diffusion distance of less than one lattice spacing is found: $x_{rms} = (Dt)^{1/2}$. At the same time we realize that a vacancy could make many jumps in 10^{-6} seconds, since the atomic vibration frequency is of the order of 10^{13}/sec, so that some clustering due to local migration

could still take place. Vacancy motion and clustering at high concentrations of defects may be aided by stress fields associated with the imperfections; this might be especially true in the jog trails (Fig. 12).

In conclusion, there may be valuable information in the time-dependent structure of the resistance change, but enough ambiguity exists among the records to discourage attempts at detailed conjecture on the physical meaning of the resistance-time structure.

J. Heat Flow Calculation and Discussion

There is significant heat flow into the silver foil from the epoxy bonding layer during the impact experiment. Epoxy being very compressible gets much hotter than silver when shocked. The single shock temperature rise at 120 kbar in epoxy is about 800°C (McQueen et al., 1970); silver temperature rises about 90°C and sapphire temperature about 16°C. In these experiments, where the shocked state is reached by wave reverberations, the epoxy temperature rise is approximately 370°C at 120 kbar.

The one-dimensional heat flow equation

$$\left(\frac{\partial u}{\partial t}\right)_x = k \left(\frac{\partial^2 u}{\partial x^2}\right)_t$$

was solved for three slabs, epoxy-silver-epoxy (u is temperature, t is time, x is position, and k is material diffusivity). Details of the solution are given in Appendix D. The solution does indicate significant heat flow into the silver