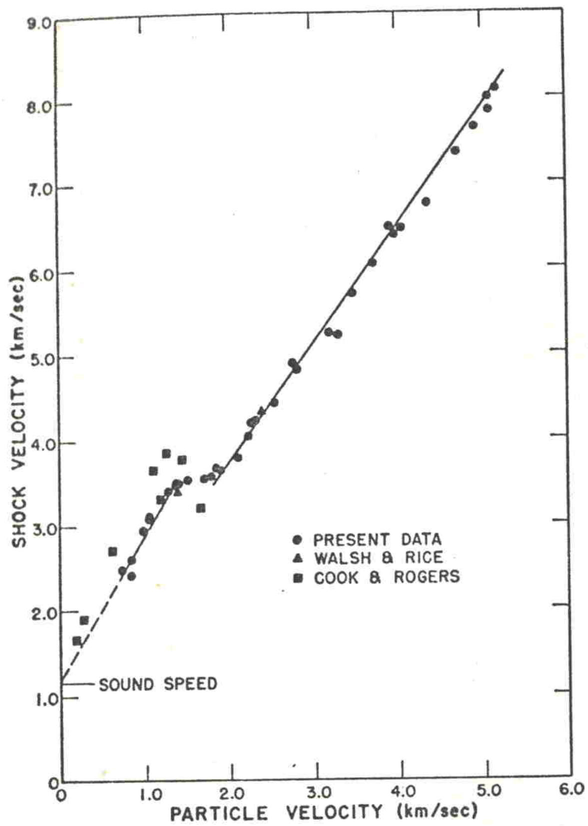

FIG. 6. Shock velocity-versus-particle velocity plot for carbon disulfide.

discontinuous change in slope and (2) there was negligible attenuation of the shock wave, indicating that a time dependent transition with a relaxation time of the order of the velocity measuring time does not occur. The absence of a double shock wave structure indicates the shock wave at the transition pressure is stable. Hence, the 133–194 kbar region may be a mixed phase region that occurs when a portion of the benzene transforms immediately to a new phase. The transformation is then complete at 194 kbar.

It is doubtful that the transition is due to freezing because the duration of the shock process is too short for rearrangement of the benzene molecules into a specific solid structure. Furthermore, pressure hinders rotation of the molecules. A temperature calculated at the beginning of the transition is 2300°K, based on the Mie–Gruneisen form[15] for the equation of state. Under these extreme conditions of pressure and temperature, the molecular bonds are distorted sufficiently that polymerization can occur. Above 194 kbar the entire volume has undergone the transition and the Hugoniot curve is that of a more compact material. The temperature at this pressure is probably above 3500°K. A dynamic high-pressure study[21] of some solid aromatic hydrocarbons (anthracene, pyrene, and phenanthrene) indicated that their behavior was similar to that of benzene. It was found that anthracene transformed at about 180 kbar, phenanthrene at about 200 kbar, and pyrene at about 240 kbar. Hence, the transition pressures of the aromatic hydrocarbons and benzene are arranged according to the complexity of the individual molecules with benzene at the lowest and pyrene at the highest pressure. Perhaps benzene and the solid aromatic hydrocarbons undergo similar transformations.

The results of electrical conductivity experiments performed on benzene indicate no appreciable increase in conductivity up to pressures of 140 kbar.

The Hugoniot curve calculated by Salzman, Collings, and Pings[22] using a Lennard-Jones and Devonshire intermolecular potential form appears to agree with the experimental Hugoniot curve up to about 130 kbar. The parameters they computed are $n=6.9$ (repulsion term), $r^*=5.92$ Å (position of the potential minimum), and $T^*=440$°K (temperature equivalent of the potential minimum).

C. Carbon Disulfide

The carbon disulfide Hugoniot data are presented numerically in Table II and graphically in Figs. 6 and 7. Distinctive features of the U_s-U_p plot of Fig. 6 are the representation of the data by two line segments separated by an interval of constant shock

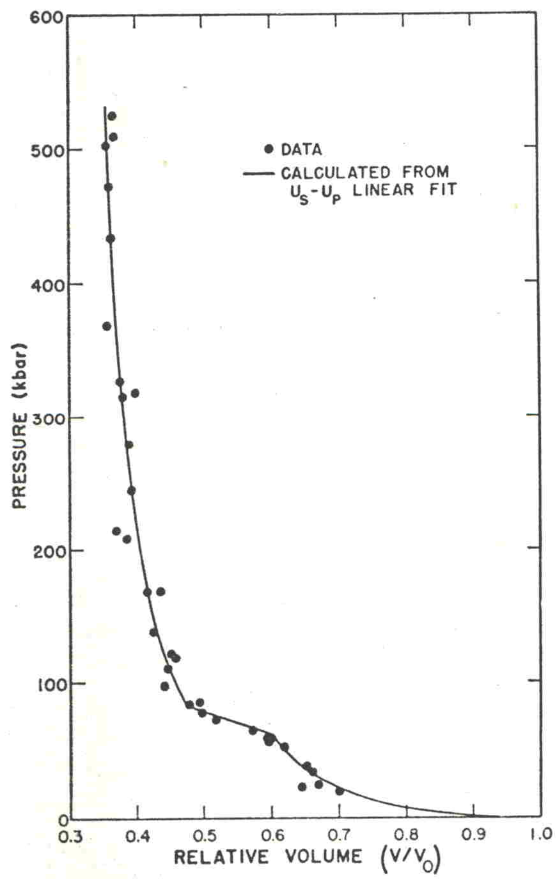

FIG. 7. Pressure-versus-relative volume plot for carbon disulfide.