

FIG. 4. Shock velocity-versus-particle velocity plot for benzene.

taken in designing the experiment to see that extraneous shock waves were not present.

III. EXPERIMENTAL RESULTS AND INTERPRETATION

A. General

The data for each liquid are presented as U_s-U_p and $P-V/V_0$ graphs. A linear relationship between U_s and U_p was observed for each of the liquids. The data were fit by a linear least-squares method to the equation

$$U_s = C + SU_p \quad (4)$$

The carbon tetrachloride and liquid nitrogen U_s-U_p data were also fit to a quadratic in U_p ,

$$U_s = C + SU_p + TU_p^2 \quad (5)$$

Benzene and carbon disulfide undergo a transition. There is less convincing evidence for the occurrence of a transition in carbon tetrachloride and liquid nitrogen.

For all materials the errors associated with the measured shock velocities represent the standard deviations computed from the linear least-squares fit of the time-distance data. These data were initially corrected for tilt in the shock wave. The standard deviations listed with the calculated values for pressure,

particle velocity, and relative volume were determined from the standard deviations computed for the measured shock velocities. The precision of the pin setback and hole depth measurements was 5μ and the precision in reading the pin signal times was 5 nsec. There was negligible attenuation of the shock wave over the distance established for measuring the shock velocity. The liquid density errors were about $\frac{1}{3}\%$ due mainly to a 2°C error in the temperature measurement.

The three organic liquids were reagent grade with a purity better than 99%. The liquid nitrogen was about 99% pure with the major impurity being oxygen.

B. Benzene

The Hugoniot data for benzene are listed in Table I. The U_s-U_p plot shown in Fig. 4 shows three line segments representing the data. An interesting feature of this graph is the short middle segment which has a relatively small slope. There is good agreement with the data of Walsh and Rice⁸ and Cook and Rogers.⁹ In the interval $2.70 \leq U_s \leq 5.83$ km/sec the fit of the U_s-U_p points is

$$U_s = 1.50 \pm 0.10 + (1.67 \pm 0.04) U_p \quad (6)$$

and from $6.26 \leq U_s \leq 9.00$ km/sec

$$U_s = 1.37 \pm 0.17 + (1.39 \pm 0.03) U_p \quad (7)$$

The short segment between $U_s = 5.83$ and 6.26 km/sec is fit by

$$U_s = 4.64 \pm 0.99 + (0.46 \pm 0.10) U_p \quad (8)$$

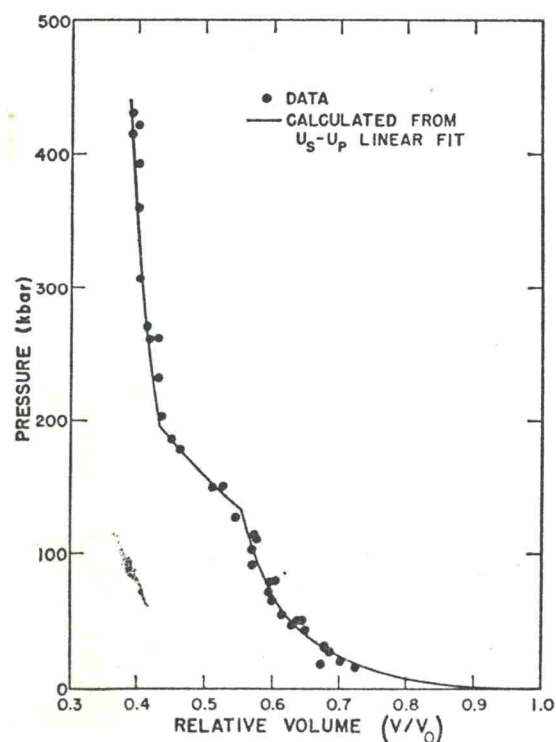


FIG. 5. Pressure-versus-relative volume plot for benzene.