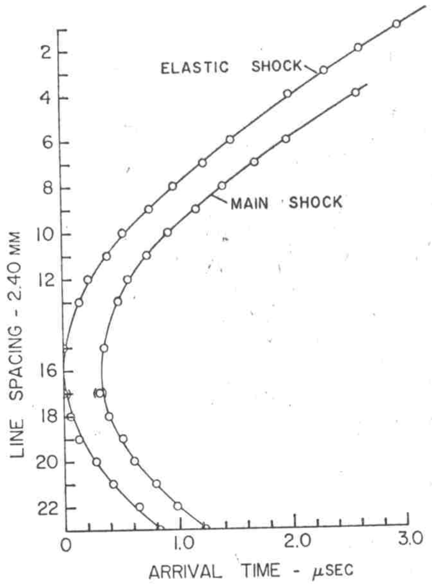

FIG. 6. Plot of shock-wave arrival across the target free-surface.

Figure 6 is a time–distance plot of the shock breakout at the polished target interface. The value of line spacing is accurate to ± 0.01 mm and shock arrival times are accurate to ± 0.04 μsec. Figure 7 compares data obtained by Fowles with data obtained in this experiment. For values of the elastic shock, the term "pressure" is interpreted as stress normal to the shock front. For data by Fowles, pressure values are accurate to $\pm 3\%$ and particle velocity values are accurate to $\pm 5\%$. Pressure values for the hypervelocity impact experiment are accurate to $\pm 5.5\%$ and particle velocity values are accurate to $\pm 8\%$. Pressure decay through the target is plotted in Fig. 8. Pressure decay of the main shock wave ranges from the inverse cube of the distance at higher pressure values to the inverse square of the distance at lowest pressure values. Maximum pressure values of the ramp between the main shock front and the elastic shock front maintain a constant pressure of 6.0 ± 0.5 kbar except near the initial breakout. The elastic shock wave decays from at least 6.2 ± 0.4 kbar to 1.5 ± 0.2 kbar. The elastic shock decays as the inverse square of the distance over the observed stress range. Small amplitude elastic waves from a spherical source theoretically decay as the inverse of the distance. The peak amplitude of the elastic shock, 6.2 ± 0.4 kbar, agrees with the nondecaying Hugoniot elastic limit measured in simpler geometries. The value of the elastic shock velocity is 6.23 ± 0.19 mm/μsec and agrees with ultrasonic measurements and measurements by Fowles.

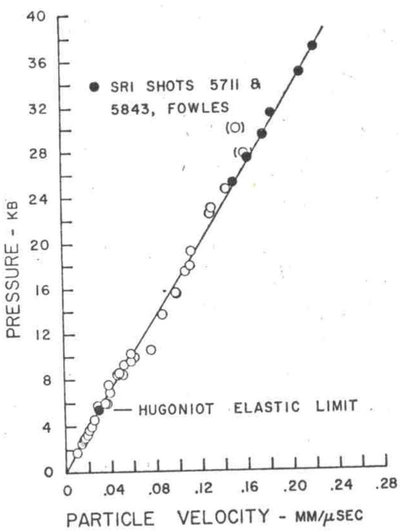

FIG. 7. Plot of pressure as a function of particle velocity, 2024-T4 aluminum.

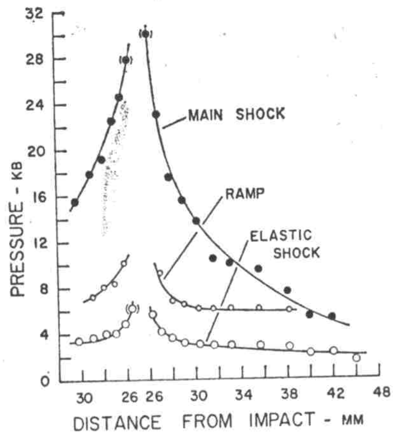

FIG. 8. Shock-wave decay as a function of distance traveled through the target.

III. CONCLUSIONS

The optical lever technique of observing shock waves is extended to hypervelocity impact experiments. A general relation for particle velocity is extended to elastic shocks and to the case of an impact off the optic axis of the experiment. An experiment using the above relation illustrates the technique. Consistent results are obtained between data from this experiment and data by Fowles. Data also extend into the pressure region below 30 kbar for 2024-T4 aluminum. The decay rate of the elastic shock wave is faster than the theoretical prediction that the amplitude should decrease as the inverse of the distance.

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