Observation of Plate Breakup

Several shots were made with a Beckman-Whitley model 189 framing camera to observe the outer surface of the driven plate in a typical plane collision assembly (1.6-mm stainless steel driver, 0.787-mm magnesium alloy buffer, 0.787-mm driven plate). The polished surface of the plate was used to reflect light from a 6-in.-diam argon flashlamp located 25 in. from the plate surface into the camera lens 170 in. from the plate. Irregularities in the plate surface appeared as dark patches. As the time and distance required for the driven plate to attain final velocity depend on the relative thicknesses, impedances, and pressure levels, it is necessary to determine these quantities in each individual case. The estimated distance required in the 2/1/1 configuration with impedance ratio of 3.5 and a driver plate velocity of 3.5 mm/μsec, based on a conservatively low value of the effective wave velocity of 5.5 mm/μsec, was found from the acoustic approximation to be not more than 0.87 times the thickness of the driven plate, i.e., about 0.69 mm, and the corresponding time required to achieve terminal velocity not more than 0.29 μsec. (In the double-collision plane shots, an interstage spacing of 0.787 mm was used, successfully.)

The framing sequences were not correlated with the start of outward motion of the plate. In no shot were irregularities of the plate noticed until the second frame after initial motion (i.e., at least 1 μsec after the initial plate motion). It was thus felt that sufficient planarity was maintained for a distance which considerably exceeded that required to achieve terminal velocity.

ACKNOWLEDGMENTS

The authors wish to acknowledge the assistance of R. E. Frie, J. E. Hudson, and J. C. Layton in the experimental arrangements and the continued encouragement of W. M. Branan and D. L. Coursen.

We should also like to thank W. E. Deal and members of the GMX-6 group at the Los Alamos Scientific Laboratory for their helpful suggestions.