B. Data Reduction

The shock velocities were determined from distances measured on the film and the known writing speed of the camera. The velocity of the second shock requires corrections because of the motion of the free surface and because of the interaction of the second shock with the reflection of the first shock. The first of these is straightforward and a simple derivation gives:

$$U_2 = \frac{d + u_{f1}(T_2 - T_1)}{T_2 - T_0} \qquad (2.11)$$

where d is the initial specimen thickness, u_{f1} is the free-surface velocity due to the first shock, and T_0, T_1, and T_2 are the arrival times of the shock fronts as shown in Fig. 2.4.

The correction due to the interaction of the second shock with the reflection of the first requires knowledge of the state (and constitutive relation) of the quartz in the region between the two fronts and cannot be made unequivocally. However, the assumption that the material is stressed and relieved only elastically by the first wave leads to a large correction and unreasonably high compression for the state behind the second shock in shot No. 7394 (Table II) The results from that shot are the most sensitive to this correction because the second shock was relatively slow with respect to the first. For the other experiments the correction is smaller and does not appreciably affect the conclusions.

It should be emphasized, however, that the result for shot 7394 implies that an irreversible change in the material properties occurs between the two shock fronts. This conclusion is consistent with the observed relaxation of the state of the first shock. It is not consistent with an assumption of conventional elastic-plastic behavior.

Because of the arbitrariness regarding the interaction correction the data are here reported without such a correction. The correction used by WACKERLE (15). is plausible, but does not significantly change the data of this paper.

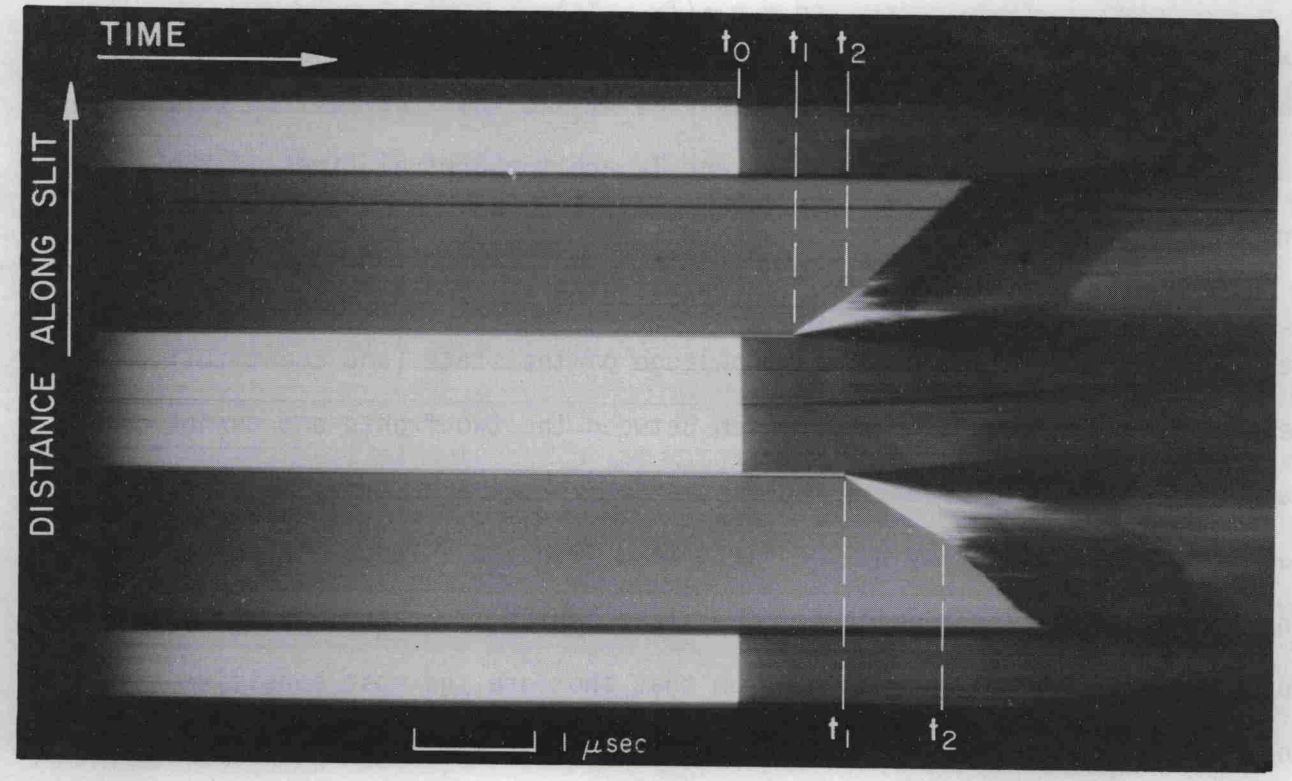

Fig. 2.4.--Streak Camera Photograph Showing Shock Arrival Times and Free-Surface Traces. Shock No. 7394.