elastic shock. Elastic reverberations between forward-facing shock fronts and free surface are ignored. Times labeled 1, 2, and 3 correspond to arrivals at the free surface of elastic, plastic I, and plastic II shocks, respectively.

Point 4 is the intersection of the forward-facing plastic II shock with the backward-facing relief wave originating at point 2. Point 4 lies on the locus of h-t points which nearly represents the path the original forward-facing plastic II shock would have taken without interference from the elastic relief wave. Coordinates of point 4 can be calculated from the results of a series of experiments with the same impact stress but different sample thicknesses, h_0. The coordinates of point 4 are given by

$$t_4 = t_2 + \frac{(t_3-t_2)\cdot U_c'}{U_c' + R_a'} , \tag{2.9}$$

$$h_4 = h_0 - \frac{(t_3-t_2)\cdot U_c' \cdot R_a'}{U_c' + R_a'} \tag{2.10}$$

where h_0 is the coordinate of the free surface. Arrival times t_2 and t_3 are measured; U_c' is assumed equal to elastic wave speed U_1.

Eulerian velocities for plastic I and plastic II waves are obtained from Lagrangian velocities through use of the relations[38]

$$U_2' = \frac{\rho_1}{\rho_0} (U_2-u_1) , \tag{2.11}$$

$$U_3' = \frac{\rho_2}{\rho_0} (U_3 - u_2) , \qquad (2.12)$$

where ρ and u are density and particle velocity, respectively, behind the wave defined by the subscript.

Elastic wave velocity, $U_1 \equiv U_1'$, was taken to be 6.18 mm/μsec.[36] Plastic I velocity (Eulerian) for individual experiments was calculated by assuming the wave to be centered at $h=0$, $t=0$, which gives

$$U_2 = \frac{h_0 + u_1(t_2 - t_1)}{t_2} . \qquad (2.13)$$

Experimental data on arrival times at the free surface for different h_0 support the assumption that the plastic I wave is centered at $h=0$, $t=0$.

2.3. Free Surface Velocity Measurements

Free surface and shock velocities were measured using the arrangement shown in Fig. 2.2. The mirrors shown were silvered on their lower surfaces and collimated light was allowed to fall on the assembly at near-normal incidence. Reflections were recorded on film in a rotating mirror camera. Part (b) of the figure represents the film record. Portions below the broken and near-horizontal lines are exposed; upper portions are unexposed.

Shock impact against a mirror surface causes the amount of light being reflected to decrease. The change in reflected light is recorded by the camera as a function of time. Time events labeled on the record are for flier arrival at the impact