EXPERIMENTAL

PRODUCTION OF SHOCK WAVES

We used three methods to generate the shock pressures.

(*a*) SINGLE SHOCK WAVES.—This method was described in our earlier paper [1] and there is no need to discuss it in detail here. Briefly, we placed the liquid in a polyethylene tube fitted over the top of a cylindrical stick of 65/35 RDX/TNT and then detonated the explosive from the bottom. A detonation wave of about 250,000 atm pressure travelled up the charge and, at the top, drove a nearly planar shock wave into the liquid. A fast oscillograph recorded the change in conductance as the shock wave passed between a pair of thin foil electrodes mounted perpendicularly to the shock front (fig. 1*a*).

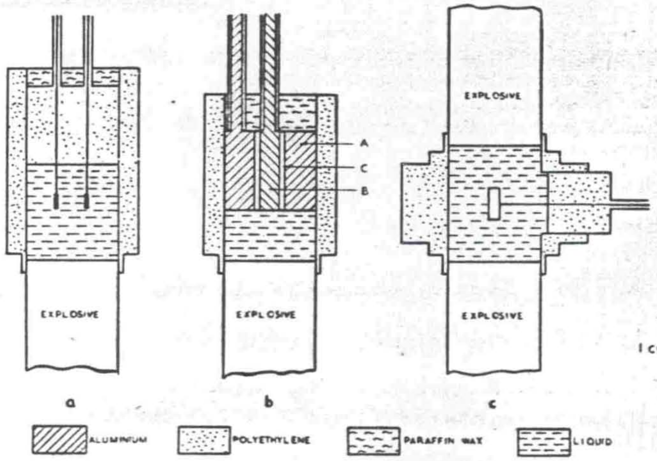

FIG. 1.—Electrodes used to measure conductivities in (*a*) single shock waves, (*b*) reflected waves, (*c*) colliding waves.

The full experimental details were given in part 5 of this series.[1]

(*b*) REFLECTED SHOCK WAVES.—In this method the shock wave was launched in the same way as in (*a*) but the electrodes, instead of being designed to offer the least resistance to the shock wave, were deliberately arranged to reflect a secondary shock back into the tail of the oncoming wave. It is known that the normal reflection of a shock wave at a rigid surface produces an instantaneous pressure which is more than twice that of the incident wave.[2, 3] But, of course, no material is completely rigid and the actual pressure reached in the reflected wave depends on the relative shock impedances of the liquid and the reflecting substance. Walsh and Rice [4] have made some direct measurements of the pressure of shock waves reflected into water from plates of 24ST aluminium and found that the intensification is roughly two-fold. We have tried to make use of this effect to extend our pressure range.

The arrangement is shown in fig. 1*b*. It consisted of two coaxial cylinders A and B, of gold-plated aluminium, separated by a Teflon sleeve C. The bottom ends of the cylinders acted both as reflecting surfaces and as the electrodes. The cell constant, measured with the electrodes mounted in the polyethylene tube, was usually about $1 \cdot 5$ cm^{-1}.

(*c*) COLLIDING SHOCK WAVES.—The head-on collision of two equal shock waves is mathematically similar to the total reflection of a single shock from a perfectly rigid wall. The pressure is therefore higher than it is for reflection at a real non-rigid surface of the kind used in method (*b*).

The pressure in the plane of collision can be found by introducing into each incident shock a " reflected " shock of sufficient intensity to reduce the flow velocity to zero. Rice and Walsh [5] have worked out the relationships between the flow velocity and pressure for incident and reflected shock waves in water, and from their results we find, for instance, that the head-on collision of two plane shock waves of 100,000 atm pressure will produce