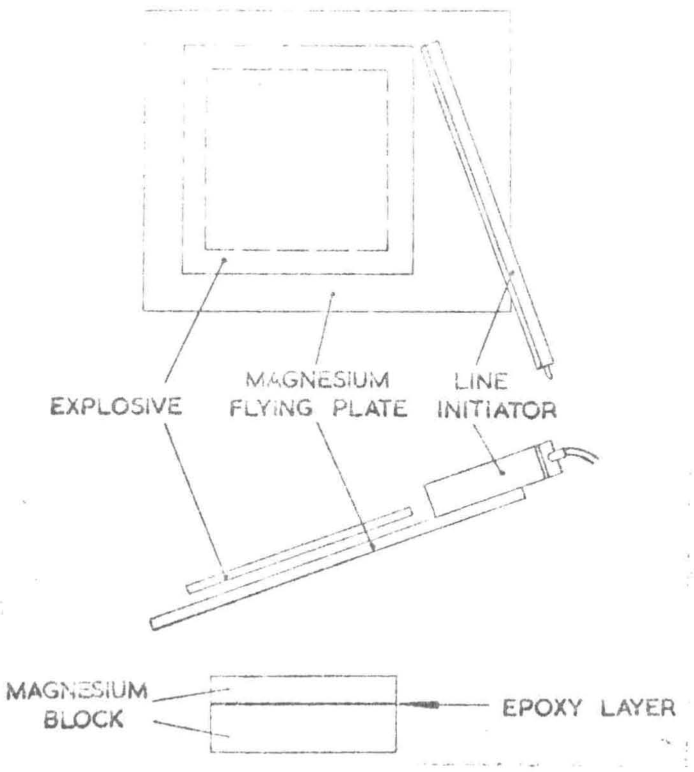

Fig. 1 - Arrangement of magnesium block and flying plate

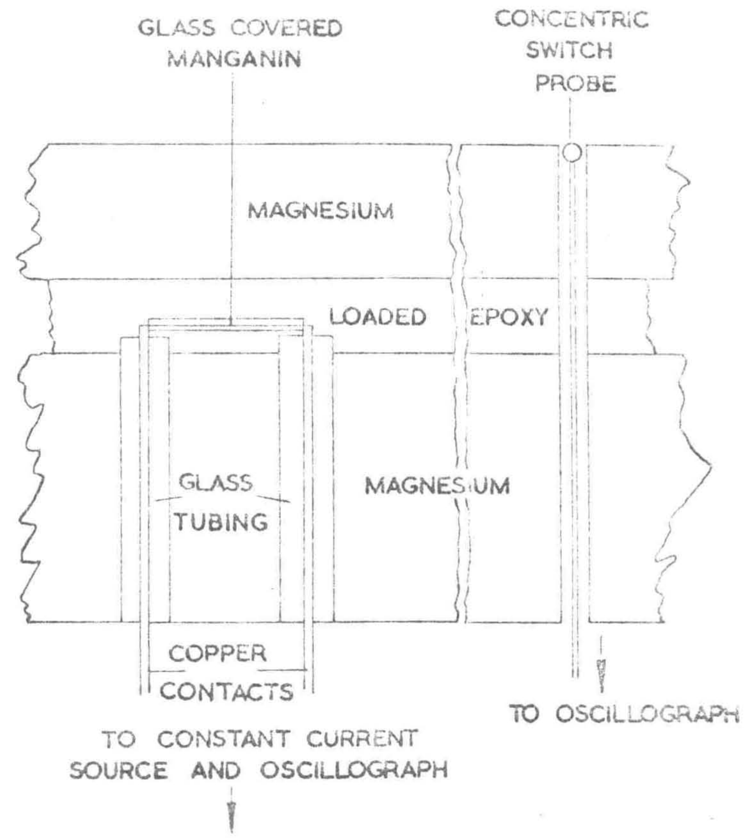

Fig. 2 - Details of transducer and insulator (not to scale)

The angle between the flying plate and the block is adjusted so as to achieve plane collision. Figure 3 shows how the shock and release waves propagate. The sides and back of the block are sufficiently remote from the transducers for reflected waves not to reach them until the measurements are completed; plane wave conditions are therefore maintained. The impact of the plate on the block is detected by capped concentric switch probes flush with the surface. In each round the square region of the flying plate striking the block is recovered in one piece and does not show any sign of scabbing.

Initially the experiments have been carried out at a comparatively low pressure of 80 Kb, a region where the strength of the metal would be expected to be important and conduction in the insulators less troublesome. The metal used was the magnesium alloy ZW 3 which has 2.9% zinc and 0.63% zirconium as its main alloying elements.

RESULTS

Figure 4a shows a typical oscillogram taken with the transducers one flying plate thickness (0.250-inch) into the block. It will be noticed that this stress-time profile is not flat-topped; there is a slight fall in stress of about 6 Kb lasting for about 0.5 microseconds after the initial rise in stress. This fall is not due to a release wave, which would have to travel at nearly infinite velocity, but is somehow associated with the shock front. Attempts to relate this fall in stress to features of the design of the experiment, such as the shock impedance of the insulator or its thickness for example, have not been successful. It could, therefore, be due to either some other property of the epoxy resin insulator or to the magnesium alloy. In a few experiments the glass tubing and the resin were replaced by thin PTFE sheet; the profiles from these shots tended to show a similar slope, but not when the magnesium was replaced by aluminium. A similar pressure-time profile has been reported in steel [8].

The stress drop due to the release wave begins at about 1.2 microseconds. The front of the release wave has a velocity of 7.3 ± 0.2 km/sec relative to the material, which is 30% higher than hydrodynamic theory would predict, about the same increase as has been estimated for other materials [2-5]. This higher velocity means that the top of the release wave should catch up with the shock at about five flying plate thicknesses into the block instead of fifteen as predicted by hydrodynamic theory. Figure 5b shows a typical oscillogram at five flying plate thicknesses.