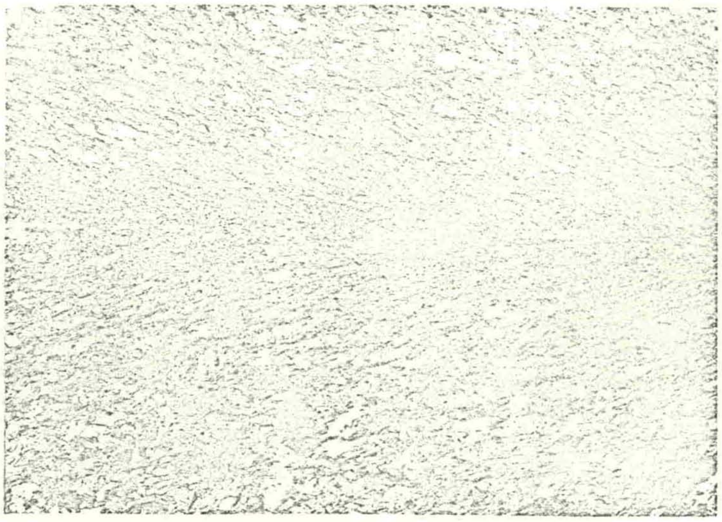
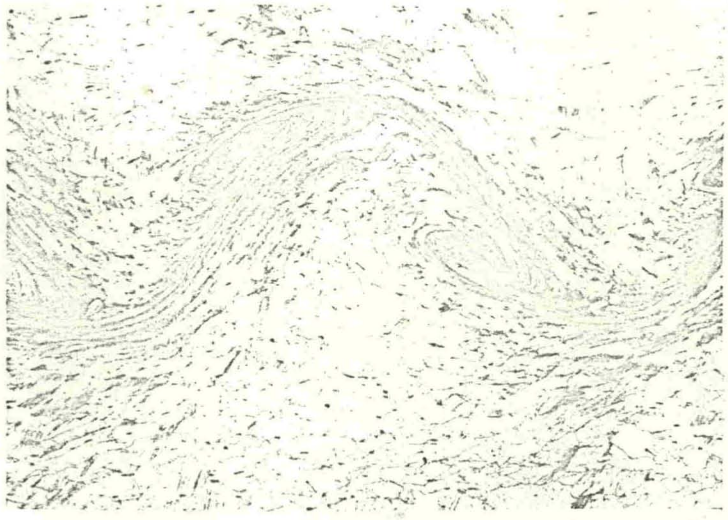
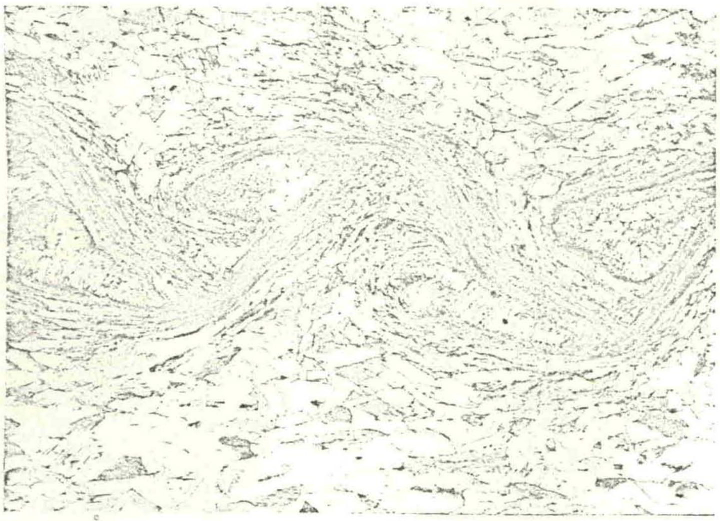


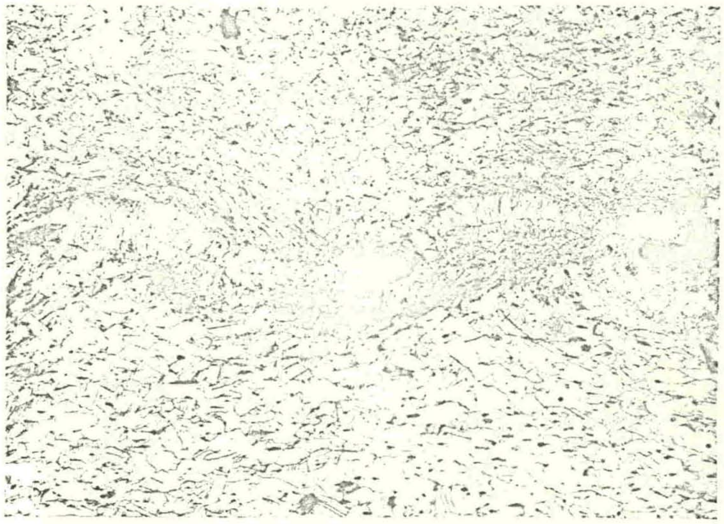
13 Straight interface in copper produced by large angle of incidence. × 90.



14 Wavy interface in copper produced by small angle of incidence. × 85.



15 Wavy interface with fusion pockets produced by small angle of incidence and excessive charge. × 100.



16 Continuous fusion weld in copper produced by high kinetic energy. × 85.

may occur on impact and on examination signs of a weld in the flyer-plate material at a point away from the interface can be observed. Apart from the possibility of spall fractures, the properties of the parent plate appear to be less critical. Thus, steel flyer plates have been successfully welded to antimony and bismuth parent plates, these being supported by mild-steel framework to prevent spalling.[32]

It should not be implied, even if all these conditions are met, that a satisfactory weld will be achieved. Carpenter *et al.*[34] have proposed an explosive-welding criterion which they claim results in explosive welding for a wide variety of metals. The equation is

$$L = K\frac{\tau e t}{d}\beta^2 \qquad \ldots [9]$$

where L = the mass of explosive per unit area of plate
e = the density of the flyer-plate material
β = the actual collision angle
t = the thickness of the flyer plate
d = the gap between the flyer and parent plate before detonation
τ = the yield strength of the flyer-plate material
K = a constant

For a non-nitroglycerine granular dynamite, provided by the Trojan Powder Company, these authors claimed a good agreement with this equation. But Shribman[35] reported that the equation did not fit his data and pointed out that the clearance d is over-emphasised, as it is only necessary to have an adequate clearance for the terminal velocity to be achieved; he found for plate thicknesses up to 0·5 in (13 mm) that the terminal velocity was achieved within 0·2 in (5 mm). Shribman concluded from his results that the optimum conditions for bonding do not necessarily lie within the limit curves prescribed by Carpenter *et al.*

Chadwick[36] states that the impact pressure must be ten times the static yield stress, which in the absence of data on the yield of metals under the impact conditions met with in explosive-welding conditions may be a satisfactory assumption. However, some materials are more strain-rate-sensitive than others, and it is probable that the magnitude of the impact pressure requires to be higher for such materials than for materials that are not so sensitive. Shribman[35] considers that a critical value of the interface pressure calculated from an equation given by Wright and Bayce[20] is required for welding. The equation is

$$p = \rho\, U_P U_S \qquad \ldots [10]$$

where p = the interface pressure
ρ = the density of the material
U_P = the particle velocity
U_S = the shock velocity in the material