4.1.2. *Dislocation multiplication*

Although the mechanism of dislocation generation due to stress concentrations at the surface irregularities of the particles appears feasible, the possibility of the induced stress at the particles causing multiplication of pre-existing interface dislocations cannot be overlooked. Thus, such a dislocation could operate as a Frank–Read source when the induced shear stress exceeds a critical value and gives rise to prismatically punched dislocation loops or dislocation tangles. The stress to operate a source of one micron (i.e. the full particle diameter) would be as low as $G/3650$ in tungsten. Experimental measurements (Garfinkle 1966) of proportional limits for high-purity tungsten single crystals give flow stresses of a similar order of magnitude (5000 p.s.i.). The computed pressure to develop such relatively low stresses at the interface of elastic discontinuities is less than 10 kilobars.

For the voids in the PM tungsten matrix, the value of the maximum shear stress computed for 25 kilobars from the mathematical model is $G/80$, which is much higher than the value estimated above for dislocation multiplication. However, no new dislocations were observed experimentally around voids after pressurization up to 25 kilobars. In the case of thoria and hafnium carbide particles, where the computed maximum values of the shear stress are $G/360$ and $G/520$, respectively, at 25 kilobars, again no dislocation generation was observed after pressure cycling. From these arguments and observations it is deduced that pressure-induced dislocations in the tungsten are unlikely to be due to multiplication of pre-existing dislocations and that stress concentrations at the matrix–particle interface appear necessary to explain their formation.

4.2. *Copper Containing Helium-filled Cavities*

The high energy (43 MeV) α-particles penetrated the copper to a depth of some 0·01 in. from the irradiated surface and came to rest in a narrow layer at that depth. The width of the layer or band of bubbles of He precipitated in this region on annealing was 0·006 in. Previous electron microscopy studies of helium precipitation in irradiated copper (Barnes *et al.* 1958, Barnes and Mazey 1960, Ghosh *et al.* 1960) have been restricted, because of the difficulties of specimen preparation, to thin foils prepared parallel to the plane of the He-rich band. The high precision microjet thinning method developed for the present study has permitted the observation of the structural features across the entire width of the band.

As illustrated in fig. 4, the structure of the band in the irradiated and annealed copper consists of large spherical bubbles (1000 Å average diameter) in the outermost regions at both sides of the band and a dense population of very small bubbles (60–70 Å in diameter) in the interior of the band. The bubbles are generally free from dislocations, except for occasional interconnecting dislocations. In contrast, after pressurization to 25 kilobars, pressure-induced dislocations are visible in the matrix at