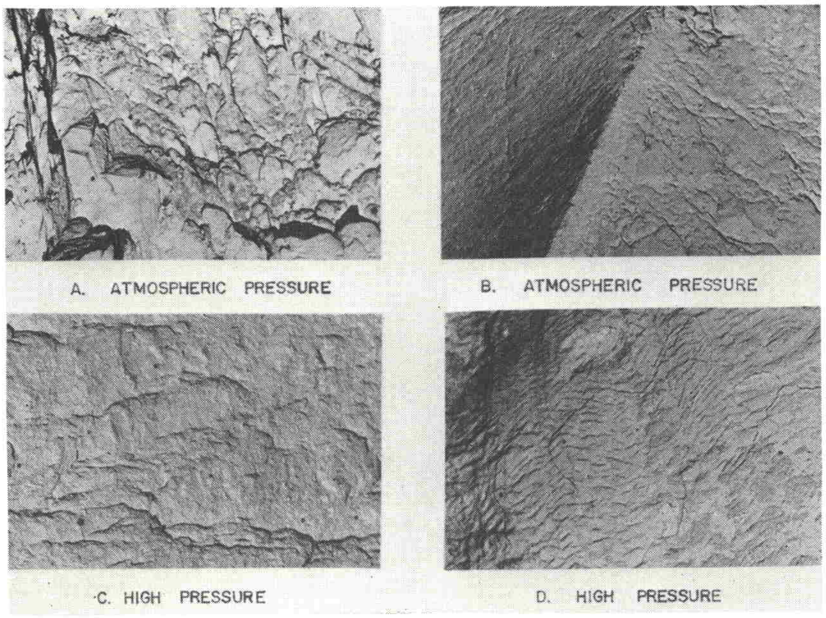

FIG. 9. Electron fractographs of magnesium fractured at $-55°C$. $\times 6,500$

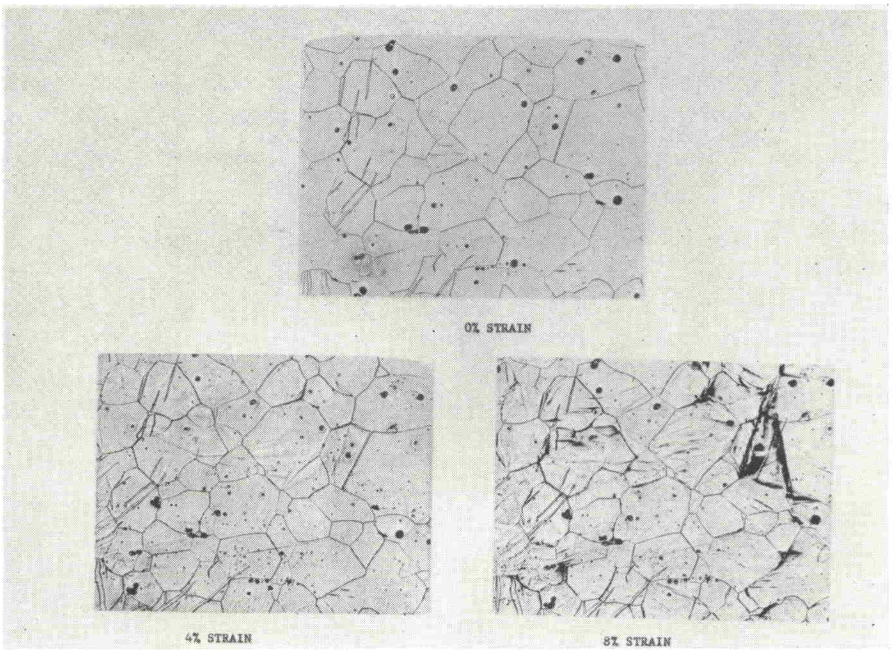

FIG. 10. Microstructures of magnesium after various values of tensile strain, 6 kb, 28°C. $\times 150$

characteristic of normal ductile fracture. Dimples are associated with voids, thus one can deduce that since no dimples occur, the superposed hydrostatic pressure has prevented the formation of voids.

Figure 10 shows the initiation of the shear fracture occurring above the transition pressure at room temperature. In this case, the sample was metallographically prepared prior to being tested. The original structure is shown in A. After 4% elongation one sees mechanical twinning, basal slip, and grain-boundary shear, all of which also occur at atmospheric pressure.[13] At 8% strain, a shear-type fracture has occurred along a localized deformation band through one of the grains. There is no evidence of multiple slip.

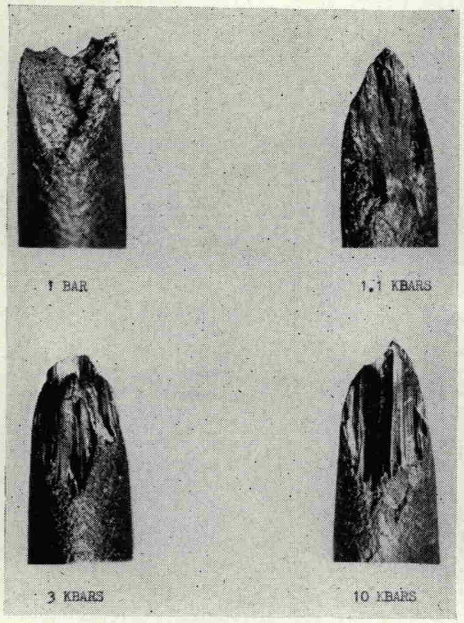

FIG. 11. Fracture appearance of magnesium as a function of pressure at 175°C.

High temperature. The macroscopic fracture appearance, as a function of pressure, at 175°C is shown in Fig. 11. Initially, one sees the elimination of the large voids characteristic of the atmospheric pressure fracture with an associated increase in necking and ductility. At slightly higher pressures, the fracture converts to the gliding type approximately along the shear plane. As in the case of the low-temperature fracture, above the transition pressure, no further change in fracture appearance occurred with increasing pressure.

An interrupted fracture above the transition pressure is shown in Fig. 12. In contrast to that observed at low temperature, no external or internal cracks were evident and the fracture occurred by gliding along a plane of intense and localized shear strain. Even in view of the high bending stresses tending to separate the surfaces, the gliding continued until the surfaces separated at a point with reductions in areas approaching 100%.

The microstructural aspects of the fracture process at high temperature are shown in Fig. 13. One first

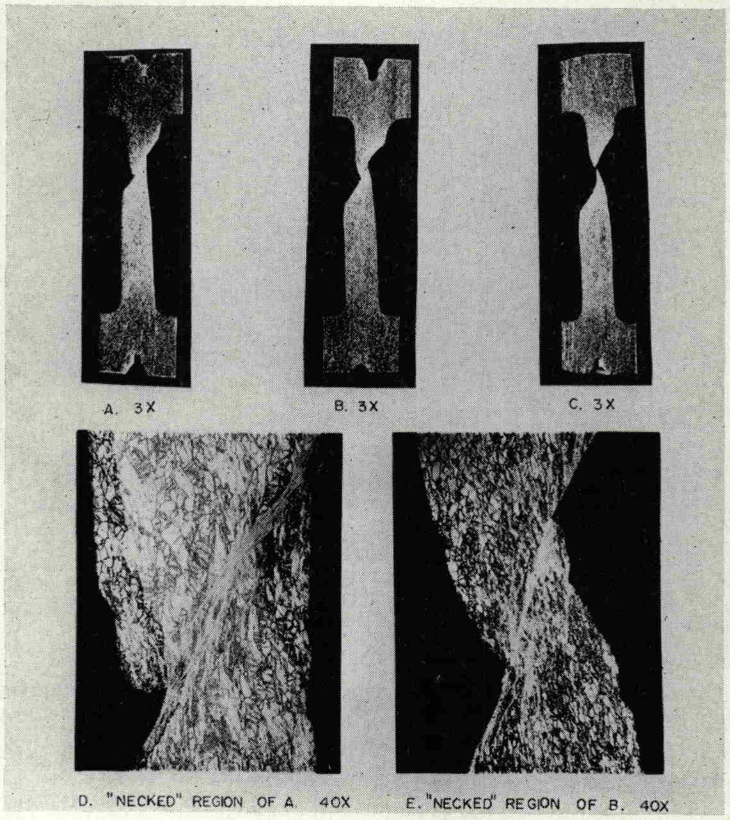

FIG. 12. Gliding type of fracturing at high pressures 175°C.