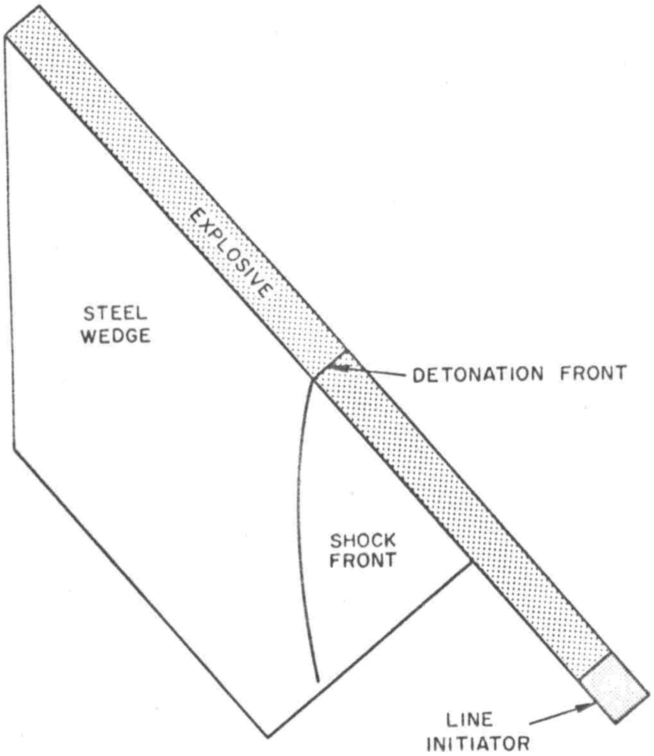

Fig. 1—Diagram of experimental arrangement.

and greater than 130 kbars. The value obtained assuming only one shock is close to 150 kbars. The average value for the ratio of thickness of heavily banded region "L" to explosive thickness "D" is approximately constant for all shots, L/D = 0.54 ± 0.03.

Bands in the microstructure of iron, known as Neumann bands, have long been recognized as products of low-pressure shock loading.[4] These Neumann bands have been positively identified as twin bands[5, 6] which form by the usual mechanical twinning mechanism. Similar twin bands are present in the lightly banded areas of the above samples. However, the large and abrupt increase in band density near the

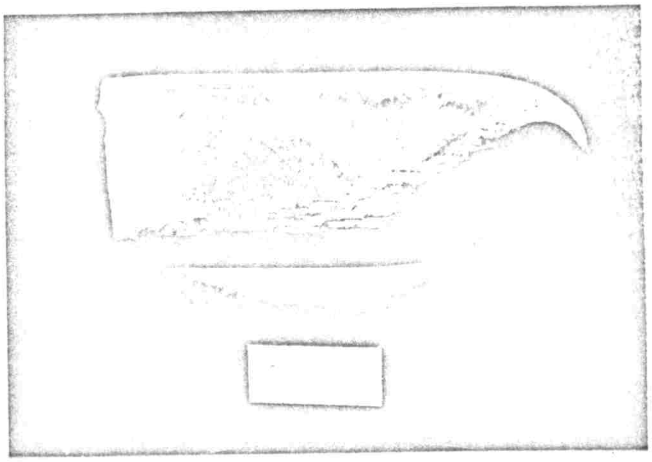

Fig. 2—Section of wedge-shaped steel specimen 2113 after detonation with 25.4 mm of explosive. Etched with 2 pct Nital. X1/2. Reduced approximately 28 pct for reproduction.

interface at a pressure somewhat greater than 130 kbars suggests that the high-density bands are not conventional mechanical twins.

The Hugoniot equation of state[1, 2] of iron at room temperatures exhibits a marked change in slope at about 130 kbars. This has been attributed[2] to a pressure-induced transformation of α iron (b.c.c.) to γ iron (f.c.c.). It is suggested that the high-density banding in the high-pressure region of these specimens was produced by the pressure-induced $\alpha \rightarrow \gamma$ iron transformation, and the reverse $\gamma \rightarrow \alpha$ iron transformation occurring during rarefaction, this transformation occurring by a martensitic (nucleation and shear) transformation instead of the usual nucleation and growth transformation.

As the pressure wave travels through the specimen, portions of each of the crystals transform from their α iron orientation to one of 24 possible related γ iron orientations. * As the pressure re-

*This figure comes from the Bowles[7] double-shear mechanism of martensite formation involving a (225) habit plane. This is reasonable since the Bowles mechanism also leads directly to twinning in ferrite and austenite.

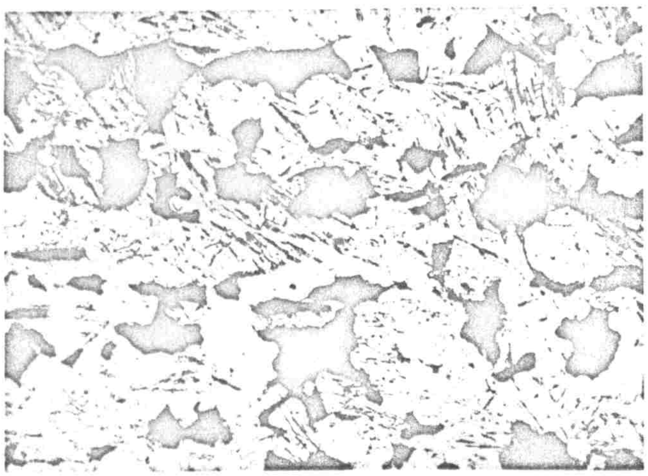

Fig. 3—Heavily banded region of specimen 2113—1mm from metal-explosive interface. Etched with 2 pct Nital. X500. Reduced approximately 25 pct for reproduction.

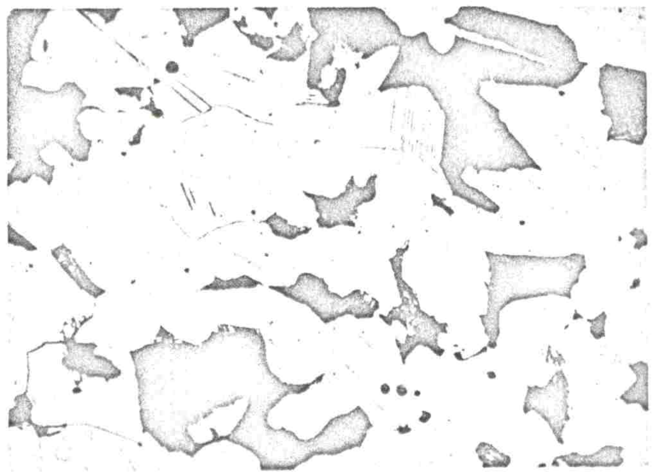

Fig. 4—Lightly banded region of specimen 2113—20 mm from metal-explosive interface. Etched with 2 pct Nital. X500. Reduced approximately 25 pct for reproduction.