September 28, 1943

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THIS DOCUMENT CONTAINS 4 PAGES.

Material Received for Examination

Imploded steel tube sample, identified by the Ordnance Group as no. 28, was received for metallographic examination. This sample was in three pieces with deep cracks running in a radial direction. Some cracks went from the center to the outside while others went within a fraction of an inch of the outside. The general shape was somewhat suggestive of a clover leaf, Fig. 1.

Macroscopic Examination

The pieces were held together for surface grinding by casting Woods Metal around the pieces. The regular hydrochloric-sulphuric acid hot etch revealed a dark core with a light exterior, unlike imploded sample 21. Fig. 1 shows the etched surface at 0.95 natural size.

Microscopic Examination

Microscopic examination of the dark and the light areas showed as in the earlier sample that the dark areas were characterized by what appeared to be profuse Neumann bands, while the light etching areas were comparatively free of banding. The Neumann bands observed on this sample were more chaotic and less distinguishable as individuals than on the previous imploded sample 21. There is possibly a slight doubt that they are Neumann bands, but intermediate etching zones seem to show Neumann bands, and hence it is inferred that the dark etching areas are areas of exceedingly profuse bands which can not be distinguised as individuals. Figs. 2-5 show the structure of various sections cut from the slab. The elongated grains shown in Fig. 2 are characteristic of transverse areas near the center of the section. Fig. 3 shows almost an equi-axed grain structure near the outside of the section. Examination of this sample showed that the grains became progressively elongated toward the center or banded region. The longitudinal sections, characterized by Figs. 4 and 5 for the banded, interior areas, show a fairly equi-axed grain structure.

Conclusions

Apparently the nature of the test was such that the interior of the imploded tube was subject to greater shock stresses than the outside. This is the reverse of the previous sample, no. 21. There is much to be learned about the origin of the banded areas, and the stresses required for their formation.

Fig. 1 Macro-Etched Imploded Steel Tube no. 28
about 0.95 natural size

Numbers 2, 3, 4, 5 show location of micrographs.

Etching Reagent: 38% HCl, 12% H_2SO_4, 50% H_2O. 170° F., 15 min.

Fig. 2 Area of Profuse Neumann Bands
Transverse Section X 100
Etching Reagent: 1% nital
Photo no. 2009

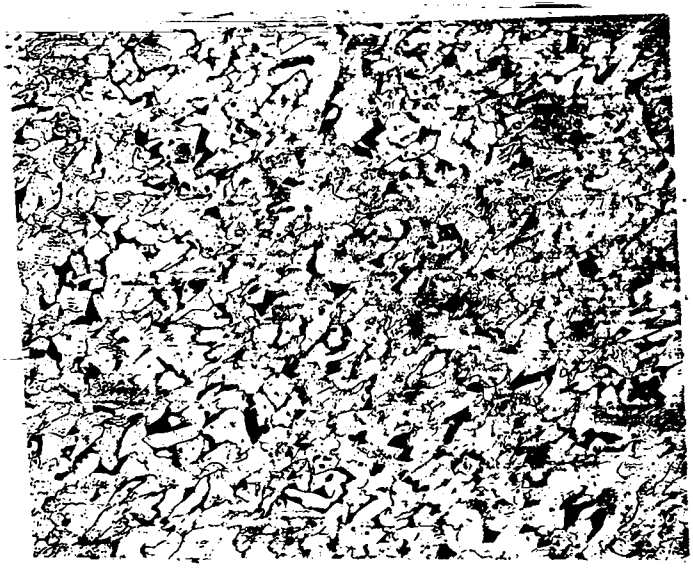

Fig. 3 Area of Normal Structure
(few or no Neumann Bands)
Transverse Section X 100
Etching Reagent: 1% nital
Photo no. 2010

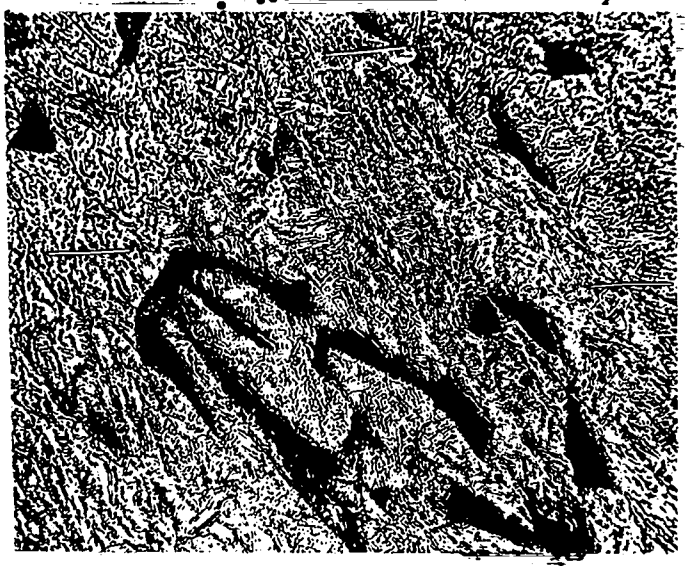

Fig. 4 Area of Profuse Neumann Bands
Longitudinal Section X 500
Etching Reagent: 1% nital
Photo no. 2011-1

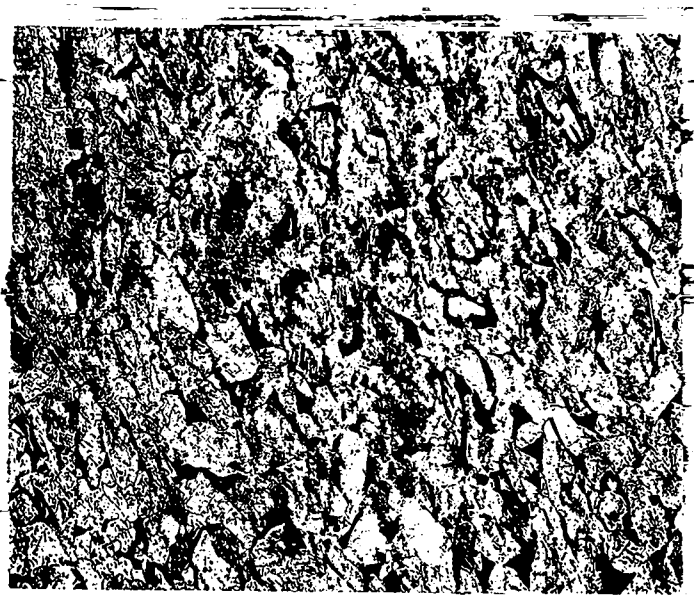

Fig. 5 Area of Profuse Neumann Bands
Longitudinal Section X 100
Etching Reagent: 1% nital
Photo no. 2011-2