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REPORT NO. P316/21-2

HYDROGEN WELDED 18/8 SHEET.

INDEXED

BY

P. R. KOSTING

June 6, 1935.

WATERTOWN ARSENAL
WATERTOWN, MASS.

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Report No. P316/21-2
Watertown Arsenal June 6, 1935

Report on Hydrogen Welded 18/8

Purpose to observe some characteristics of hydrogen welded 18/8 sheet supplied by E. B. Badger & Sons, Boston.

Conclusions

Hydrogen welding 18/8 sheet apparently results in a much better weld than acetylene welding from a corrosion point of view.

The welded sheet both before and after annealing passed the Huey test and Strauss test. 1850°F is a sufficiently high enough temperature for annealing. This annealing not only redissolves precipitated carbides but also removes cast structure from weld metal.

Material

A portion of an expansion joint hydrogen welded from 18/8 sheet, approx. 19 gauge, supplied by Crucible Steel Company, their product KA2SF8, was submitted for examination.

Examination

Upon visual examination the welded joint was found not to be uniform. At quite a few places perfect fusion throughout the thickness of sheet had not occurred. On

the underside crack-like fissures were apparent. On the top side the bead showed up excellently, little excess metal being built up.

Only those portions of the weld that looked like good workmanship were further tested. The Huey test and Strauss test were carried out and a metallographic examination was made of the joint both as received and after heating to 1850 and to 1950°F, holding 1 hour and quenching in water.

The Huey Test

The Huey test was carried out by suspending a strip of metal with weld at mid-point in boiling 67% c.p. nitric acid for three 48 hour periods. The weight losses were calculated over to inches penetration per month and totalled up for the three periods. The corrosion rate found was 0.0027" per month for the specimen quenched from 1950°F, and 0.0024" per month for the specimen in the "as received" condition. These figures are characteristic of good quality metal. The area of weld exposed was a small fraction of the total area. There is evidence that stresses left in the quenched specimen from shearing, when preparing the samples for study, were considerable and more than in other specimens. This may account for the slightly

increased corrosion rate observed for the quenched specimen as compared to that of the "as received" specimen with its precipitated carbides.

The Strauss Test

Specimens were boiled for 72 hours in a solution of 3% $CuSO_4$, 10% H_2SO_4, 87% H_2O, after which they were bent 180°. Bending was carried out both perpendicular to and parallel to the weld. No cracking was observed.

Metallographic Study

The weld was found to be sound. The weld metal was fine grained. Carbides were precipitated along and within grain boundaries in a zone some 3 1/2 mm away from the edge of the weld. Heat treatment at 1850°F and at 1950°F removed the precipitated carbides and also removed all but traces of the cast structure in the welded joint. Microphotographs are shown on Figures 1 to 3. Etching difficulties resulted in pitting of the specimen.

Discussion

Hydrogen welding of 18/8 sheet forms a much better weld than acetylene welding, judging from the corrosion point of view and also from its appearance.

When tested in the Strauss test no cracking occurred which might be expected from a study of the precipitated carbides. They are discontinuous. How much of this is a function of welding technique and how much is a function of metal composition is difficult to say, the greater portion if not all the phenomenon being governed by composition.

Annealing at 1850°F is sufficient to bring all precipitated carbides into solution and to get rid of a large portion of the cast structure of the weld. The weld so treated would have its corrosion resistance improved.

Respectfully submitted,

P. R. Kosting

Fig. 1. Hydrogen welded 18/8 sheet showing (top right) weld metal and junction with sheet metal and (bottom) carbides precipitated at grain boundaries, shown with arrow, in heat affected zone.

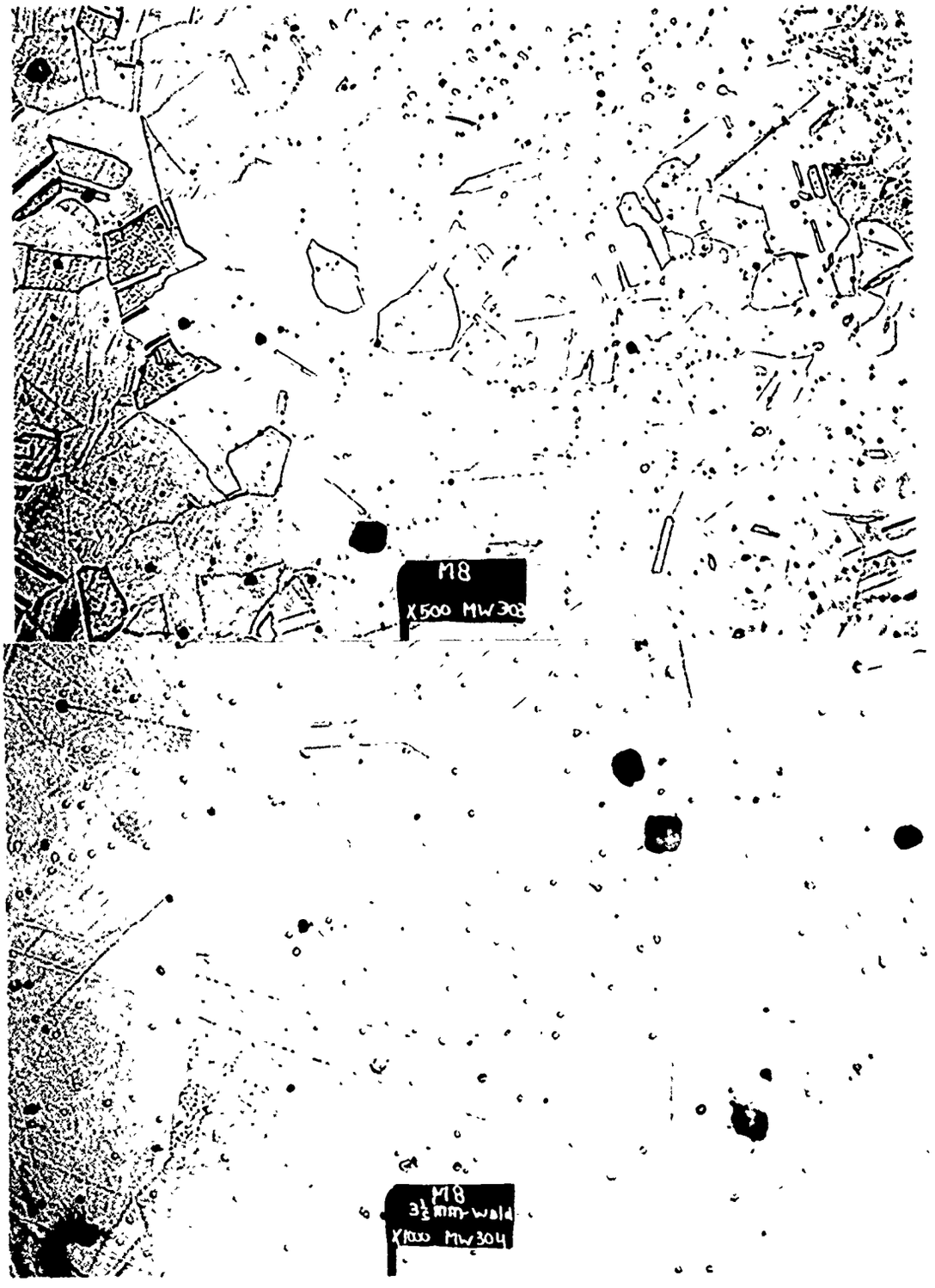

Fig. 2. Same as Figure 1 after water quench from 1850°F. Top right shows weld metal and bottom shows absence of precipitated carbides in heat affected zone.

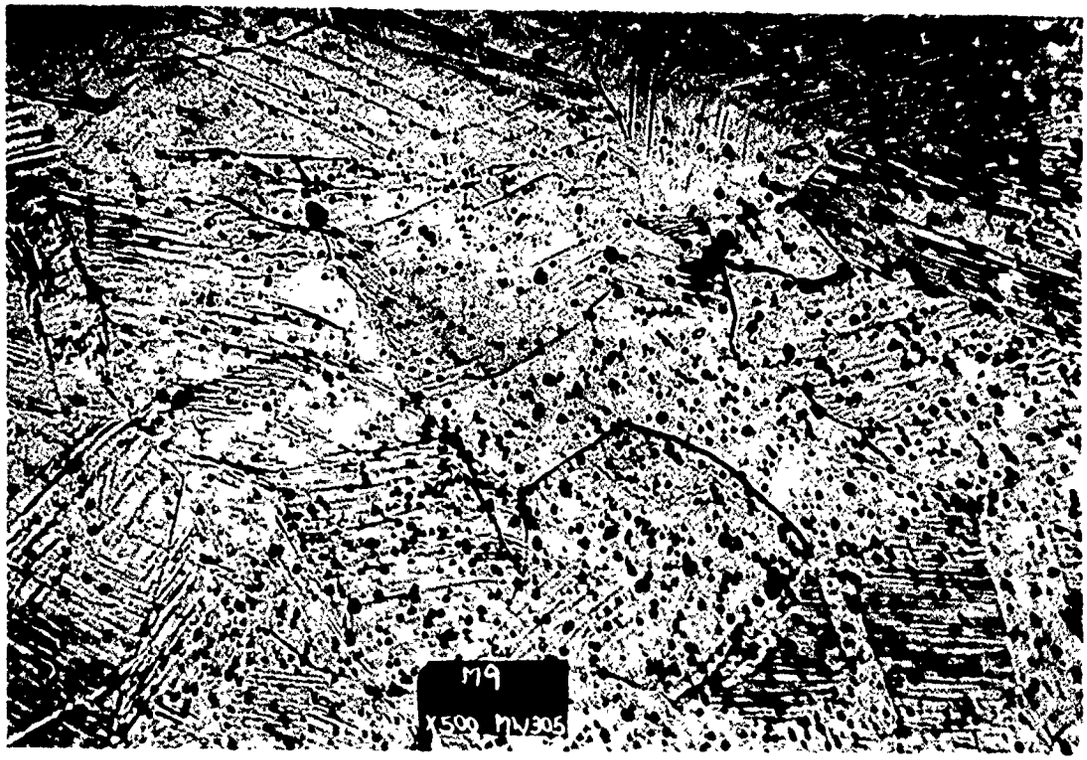

Fig. 3. Junction of sheet with weld metal after water quench from 1950°F. Stress left in sheet from shearing while preparing specimen apparent. Weld metal located with difficulty.