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O T T A W A August 21st, 1941.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1070.

Season Cracking in Brass Primer Bodies.

BUREAU OF MINES
DIVISION OF METALLIC MINERALS

ORE DRESSING AND
METALLURGICAL LABORATORIES

CANADA
DEPARTMENT
OF
MINES AND RESOURCES
MINES AND GEOLOGY BRANCH

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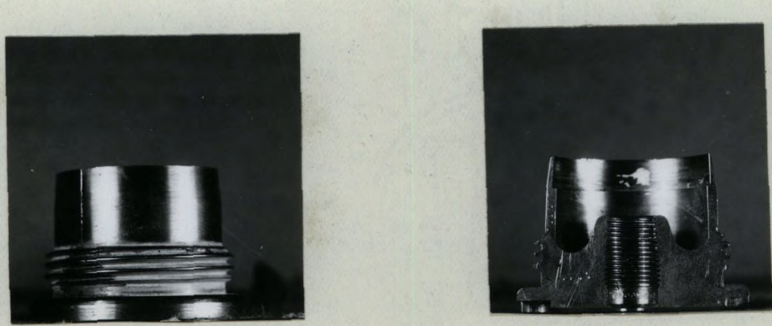
Origin of Problem:

On August 14th, 1941, three brass parts, reported to be primer bodies, were received from Mr. H. H. Scotland, Inspector of Materials, Inspection Board of the United Kingdom and Canada, 58 Lyon Street, Ottawa, Ontario, for examination and report. (Requisition J.M.G. 1014).

Description of Parts Received:

Figure 1 shows two of the parts reported to be primer bodies. One part was seen to have an irregular radial crack extending from the centre to the outside.

Figure 1.



PARTS AS RECEIVED.

Tool marks indicated that the parts were machined from bar stock.

Hardness Tests:

Location.		V. H. N.
Thin part of cylindrical section	-	86
¼ in. below the surface at external threaded section	-	96
On base: 0.05 in. from centre hole	-	91
0.10 " " " "	-	86
0.20 " " " "	-	88
0.25 " " " "	-	89
0.30 " " " "	-	89
0.40 " " " "	-	89
0.50 " " " "	-	96
0.55 " " " "	-	106

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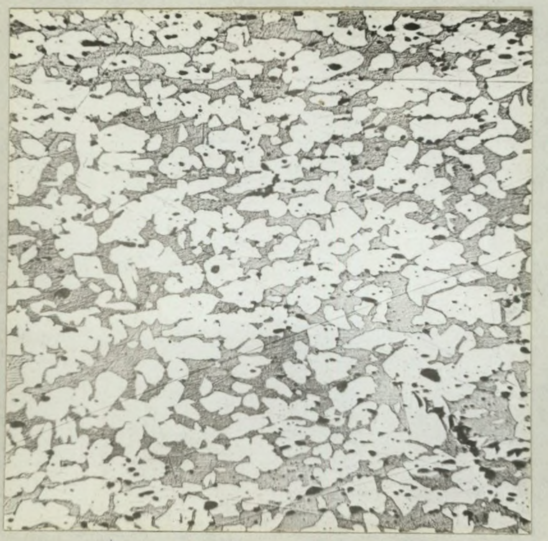
Chemical Analysis:

		Per cent
Copper	-	57.63
Zinc	-	39.49
Lead	-	2.61
Iron	-	0.15

Microstructure:

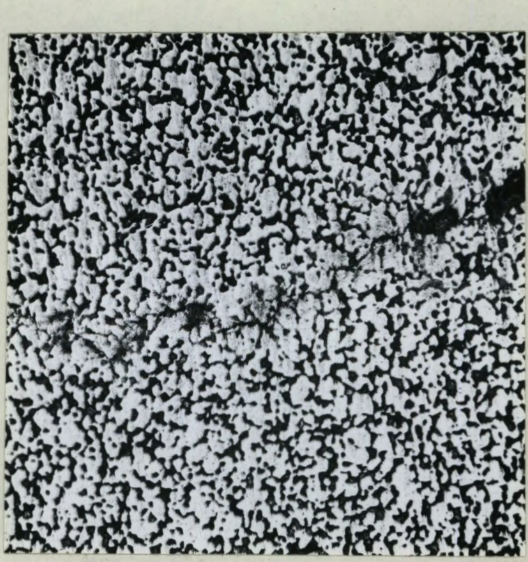
Figure 2.



X100, NH_4OH Etch.

LONGITUDINAL SECTION.

Figure 3.



X100, NH_4OH Etch.

TRANSVERSE SECTION.

Through Cracking.

Figure 2 shows that the material was free-cutting leaded yellow brass. It is in the alpha + beta form with a fairly fine grain size. Figure 3 shows the intercrystalline crack passing through the beta phase.

Strain Test:

It was decided to test the metal in the primer body for internal strain. This was done by machining a ring from the base (see Figure 4). The ring was then clamped in a vise and a saw-cut made through it. After measuring the gap, the ring was removed from the vise. The gap was measured again.

(Continued on next page)

(Microstructure, cont'd) -

It was found to have decreased from 0.029 in. in width to 0.014 in. This was taken as proof that strain existed in the metal.

Figure 4.

Ring Test for Strain.

DISCUSSION OF RESULTS:

The parts examined were turned from free-cutting leaded yellow brass bar stock. Intercrystalline failure through the beta phase identifies the failure as the "season cracking" type. This phenomenon is generally attributed to selective corrosion attack on the metal while it is internally stressed. Both hardness and "ring" tests indicate that a layer of metal at the surface of the bar was under tension. Corrosion from the atmosphere or from cutting coolants attacked the metal and produced the crack.

S. A. E. specification No. 88, Brass Rod, requires:

		Per cent
Copper	-	57.9 - 62.1
Lead	-	1.8 - 3.0

(Continued on next page)

(Discussion of Results, cont'd) -

The standard S. A. E. test for detecting strain in copper-zinc alloys is the "strain test". A full-size test specimen must stand immersion for 15 minutes without cracking in an aqueous solution containing 100 grams of mercurous nitrate and 13 c.c. of nitric acid (specific gravity 1.42) per litre.

Had the above test been carried out on the bar stock, it is probable that the cracking condition would not have occurred. Season cracking will not occur without some corrosive agent present. The cutting coolant and other liquids and gases which come into contact with this part should be examined carefully. Internal strains can also be set up by threading one part on another too tightly, i.e., in gauging or assembly. Strains are easily removed from brass by a low-temperature anneal. Certain mechanical treatments of bar stock have been found to remove internal strain.

Conclusions:

1. The primer body examined cracked due to stress corrosion attack, usually called "season cracking".

2. Skin-stressed bar stock was not rejected by the purchaser.

3. Some corrosive agent attacked the stressed metal after it was machined.

4. The undesirable condition of internal stress can be easily removed by mechanical or thermal treatment of the bar stock.

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