O T T A W A September 12th, 1941.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1092.

Examination of Cartridge Brass Which Had Cracked in the Cupping.

BUREAU OF MINES
DIVISION OF METALLIC MINERALS
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CANADA
DEPARTMENT
OF
MINES AND RESOURCES
MINES AND GEOLOGY BRANCH

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Origin of Request:

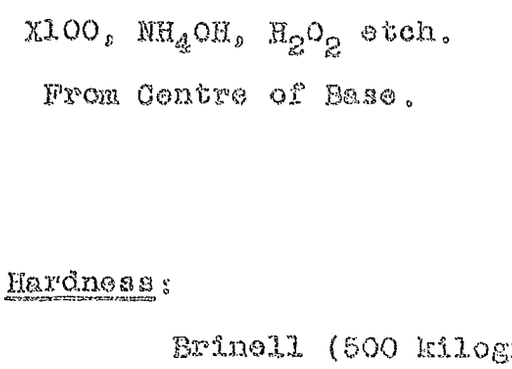
On September 6th, 1941, Mr. H. H. Scotland, Inspector of Materials, Inspection Board of United Kingdom and Canada, 58 Lyon Street Ottawa, Ontario, reported by telephone that some difficulty in cupping cartridge brass disks had been encountered. Mr. Scotland requested (Analysis Requisition No. J.M.G. 1108) that an examination be carried out in order to determine the cause of the cracks.

Nature of Sample:

The two brass cups received had a wall thickness of about $\frac{1}{8}$ inch. One cup appeared to have cracked all the way around the base and a disk separated entirely from the cylindrical part of the cup. It was quite obvious that the forming operation had ruptured the metal.

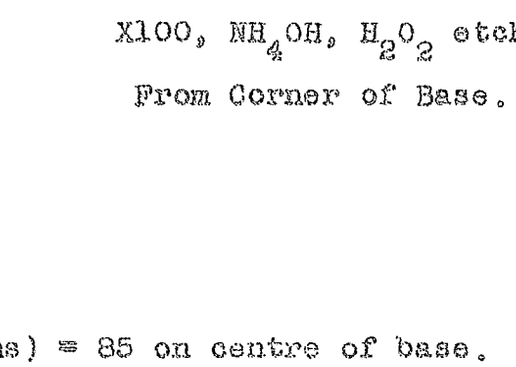
Micro-Examination:

Figure 1.



X100, NH_4OH, H_2O_2 etch.
From Centre of Base.

Figure 2.



X100, NH_4OH, H_2O_2 etch.
From Corner of Base.

Hardness:

Brinell (500 kilograms) = 85 on centre of base.

Other readings taken with a Vickers pyramid tester showed that in parts of the cup the hardness was in excess of 200 B.H.N.

Chemical Analysis:

Copper	-	70.65 per cent
Zinc	-	29.20 "
Lead	-	None
Iron	-	"
Tin	-	"
Aluminium	-	"
Phosphorus	-	"
Silicon	-	"
Nickel	-	"

Physical Tests:

Standard tensometer test pieces were prepared having a diameter of 0.159 inch. In order to determine the working properties of the brass, annealing at various temperatures in a salt bath was carried out. The results were as follows:

Physical Properties

Heat treatment	Yield point, p.s.i.	Ultimate load, p.s.i.	Elongation, per cent	Reduction of area, per cent
As received	72,500	77,000	10	55
500°F, one hour	70,000	76,000	11	57⅓
625°F, "	32,500	58,000	31½	72
750°F, "	22,500	55,000	43	70
915°F, ½ hour	15,750	50,250	--	--
1050°F, "	12,500	47,500	57	77

Discussion:

The microstructure shows this material to be cold-worked alpha brass. Chemical analysis indicates a standard cartridge brass of high purity. From hardness test values it is apparent that the brass has been work-hardened beyond its capacity to deform without rupture. Physical tests bear out this conclusion and show that with the proper annealing treatment a soft plastic metal will result.

(Concluded on next page)

(Discussion, cont'd) -

A.S.T.M. Designation B 20-29 for Cartridge Brass Disks requires that:

"the brass shall be so annealed that the average of ten Brinell hardness readings from a lot will be within the limits of 49 to 65, using a 10-millimetre ball with a pressure of 500 kilograms."

If this specification had been adhered to, cracking in forming would not have occurred.

Conclusion:

Cartridges cracked in the cupping operation because they were not annealed to the proper degree of hardness.

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