

*File*

FILE COPY

O T T A W A

May 18, 1945.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1872.

Cause of Corrosion in Pattern 0921 Compasses.

=====

(Copy No. 10.)



O T T A W A      May 18, 1945.

R E P O R T  
of the  
ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1872.

Cause of Corrosion in Pattern 0921 Compasses.

=====

Background:

The report of O.D.M.L. Investigation No. 1825, entitled "Corrosion Products in Pattern 0921 Compasses," was submitted to Commander F. G. S. Peile, R.N., of the British Admiralty Technical Mission, Ottawa, Ontario, on March 29, 1945. In a letter (File No. 33-4-2-1) dated April 11, 1945, Commander Peile requested that an analysis be made of:

- (1) Alcohol-containing liquid used in the manufacture of Pattern 0921 compasses in Canada.
- (2) Alcohol used in the manufacture of these compasses in Canada.
- (3) Alcohol-containing liquid taken from compass Pattern 0921 No. 233H which was manufactured in England.
- (4) Black Amercoat paint (under coat).
- (5) Black Amercoat paint (finishing coat).

In a letter dated April 20 it was reported to Commander Peile that the sample of alcohol (Item 2 above)



(Background, cont'd) -

was yellow in colour. Arrangements then were made by Commander Peile's office for another sample of alcohol and a sample of distilled water to be submitted by the Ontario Hughes-Owens Company, Ottawa. This sample of alcohol was found to be colourless and it was analysed instead of the coloured sample.

Comparison of Canadian and English Compass Liquids:

The following results were obtained, using the tests outlined in the compass specifications submitted by Commander Peile:

	: Specific Gravity	: Canadian Compass Liquid	: English Compass Liquid
Specific gravity at 15.5° F.	: 0.93	: 0.931	: 0.927
Alcohol (by weight)	: - -	: 44.20 per cent	: 45.88 per cent
Residue	: - - -	: 0.005 per cent	: 0.002 per cent
Free acid, number of drops of N/10 caustic soda	: - -	: 1 drop.	: 1 drop.
Free bases	: - - -	: None detected.	: None detected.
Esters	: - - -	: None detected.	: None detected.
Mineral, oily, resinous substances	: - - -	: None.	: None.
Aldehydes	: - - -	: Very faint trace.	: Very faint trace.

Properties of the Alcohol Used in Canadian Compasses:

The following results were obtained when the colourless sample of Canadian alcohol was tested according to the compass specifications:

(Continued on next page)



(Comparison of Canadian and English Compass Liquids, cont'd) -

	: Specification	: Canadian
	: Value	: Alcohol
		: Colourless Sample
Specific gravity at 15.5° C.	: Less than 0.797.	: 0.815
Alcohol (by weight)	:	: 92.63 per cent
Residue	: Less than 0.01 per cent.	: 0.004 per cent
Free acid, number of drops of N/10 caustic soda.	: Less than 2 drops.	: Less than 2 drops.
Free bases	: Less than 0.01 per cent.	: None detected.
Esters	: None.	: None detected.
Mineral, oil, resinous substances	: None.	: None detected.
Aldehydes	: None.	: Extremely small trace.

Spectroscopic Examination:

I.

Samples of the Canadian compass liquid, the colourless Canadian alcohol, and the liquid from the English compass were evaporated to dryness and the residues were analysed for metallic constituents by means of the spectroscope, with the following results:

Importance of Constituents	: English Compass Liquid	: Canadian Compass Liquid	: Colourless Canadian Alcohol
Most prominence	: Magnesium : Silicon : Calcium : Aluminium : Boron : Sodium	: Magnesium : Silicon : Calcium	: Magnesium
Intermediate prominence	: Lead : Copper : Zinc : Manganese : Iron : Nickel	: Aluminium : Boron : Copper	: Silicon : Calcium : Aluminium : Sodium : Copper : Zinc : Manganese
Least prominence	: Chromium : Silver	: Lead : Manganese : Iron : Chromium : Silver	: Lead : Iron : Chromium : Silver

(Continued on next page)



II.

Samples of the Amercoat under and finishing coats were analysed for their metallic constituents by the spectroscope with the following results:

Importance of Constituents	:	Under Coat	:	Finishing Coat
Most prominent	:	Magnesium	:	Silicon
	:	Silicon	:	Aluminium
	:	Aluminium	:	
	:	Sodium	:	
	:	Manganese	:	
	:	Iron	:	
	:	Titanium	:	
Least prominent	:	Lead	:	Magnesium
	:	Copper	:	Iron
	:	Nickel	:	Lead
	:	Chromium	:	Copper
	:		:	

Examination of Distilled Water:

The electrical conductivity of the distilled water submitted by the Ontario Hughes-Owens Company was determined, in order to obtain an estimate of its purity. It was found to have the conductivity of absolutely pure water containing 0.3 part per million of sodium chloride.

Freshly distilled water prepared in these Laboratories has the conductivity of pure water containing less than 0.1 part per million of sodium chloride. However, distilled water prepared the same way but allowed to stand for some time had the conductivity of pure water containing 3.5 part per million of sodium chloride. This increase in conductivity was due to the solution of carbon dioxide and material from the walls of the container.

Conclusions:

1. The alcohol content of the Canadian compass liquid is slightly lower than that of the English liquid.
2. More residue is present in the Canadian compass



(Conclusions, cont'd) -

liquid than in the English liquid.

3. In other respects there is little difference between Canadian and English compass liquids.

4. The colourless sample of Canadian alcohol had a higher specific gravity than allowed by the specifications, i.e., it probably contained more water.

5. In other respects the Canadian alcohol was satisfactory according to the specifications. It is anticipated that the extremely small trace of aldehydes which was detected would not be harmful.

6. The distilled water was of satisfactory purity.

7. The spectroscopic examination of the residues from the Canadian compass liquid, English compass liquid and colourless Canadian alcohol showed approximately the same metallic constituents to be present in each. There was a considerable similarity in the order of importance of these metallic constituents in the three liquids. As far as can be judged, these metallic constituents are not likely to be harmful. Titanium is the only metal occurring in the paints which does not occur in the residues from the liquids.

8. The acid radicals with which the metals in the paints are combined would determine to a considerable extent the amount of corrosive action which the paints would have on the metal underneath.

It is thought that an excessive amount of free fatty acid may be present in one or both of the paints. Unfortunately, due to the lengthy illness of one of the members of the staff, these Laboratories are not in a position to analyse these materials for free fatty acids at the present time.

ooooooooooooo  
oooooo  
oo

RRR:LB.