O T T A W A June 26, 1945.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1896.

Cause of Corrosion of Metal Parts For Marine Compass W.D. 32.

(Copy No. 10)

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Background:

A letter dated June 6, 1945, Reference 33-4-7, from Commander F. G. S. Peile of the British Admiralty Technical Mission, 58 Lyon Street, Ottawa, Ontario, requested that an analysis be made of various metal parts which were being submitted (three stems, three cup holders and three split sleeves). Also, suggestions were requested as to the cause of the excessive discolouration of the metal when immersed in compass liquid (S.G. 0.81) which was previously analysed in these Laboratories and found to be satisfactory. The parts were supposed to be made of 20 per cent nickel silver.

(Background, cont'd) -

A completely assembled compass was also submitted for observation of the type of discolouration produced.

TESTS PERFORMED:

The metal parts submitted were first analysed spectrographically, to obtain information regarding the constituents present and their importance. They were then analysed chemically for copper, zinc and nickel. Due to their small size they could not be analysed chemically for their minor constituents.

I. Spectrographic Analysis.

The results of the spectrographic analysis were as follows:

Part	CONSTITUENTS OF Greatest Importance	Intermediate Importance	Least Importance
Stems	Zinc Copper Nickel	Manganese	Lead Magnesium
	Zinc Copper Nickel	Manganese	Lead Magnesium Silicon
	Zinc Copper Nickel	Manganese Silicon	Lead Magnesium
Cup Holders	Zinc Copper	Lead Magnesium	Silicon
	Zinc Copper Nickel	Lead Magnesium Silicon	Cobalt
	Zinc Copper Nickel	Lead Magnesium Silicon	Cobalt
Split Sleeves	Zinc Copper Nickel	Magnesium Silicon	Manganese
	Zinc Copper Nickel	Magnesium	Manganese Silicon
	Zinc Copper Nickel	Magnesium	Manganese Silicon

(Tests Performed, cont'd) -

It was reported that in every case the iron content was lower than 0.1 per cent and probably lower than 0.01 per cent.

It will be noted that:

(a) One of the cup holders contained no nickel at all.

(b) The elements in the second and third columns probably are of little importance to the present problem.

II. Chemical Analysis.

The results of the chemical analysis were as follows:

Part	Copper, per cent	Zinc, per cent	Nickel, per cent
Stems	64.39	21.90	12.58
	64.41	21.62	12.24
	60.95	24.62	12.62
Cup Holders	62.07	34.56	Nil.
	58.21	34.72	0.14
	65.08	35.15	0.40
Split Sleeves	67.03	21.96	10.32
	70.28	19.41	8.48
	65.75	22.15	11.24

It is understood that the specification requirements for 20 per cent nickel silver are:

	Per Cent
Copper	60-65
Nickel	19-21
Iron	0.30
Lead	0.04
Other elements	0.30
Zinc	Balance.

It will be noted that:

(a) One of the cup holders and two of the split sleeves were considerably outside specifications with regard to copper content.

(b) All but one of the parts were higher in zinc content than allowed by the specification. The three cup holders were very high in zinc content.

(Continued on next page)

(Tests Performed, cont'd) -

(c) The nickel content of all of the parts was considerably below specifications. In one of the cup holders there was no nickel and in the other two the amount of nickel was negligible.

CONCLUSION:

The discolouration of the metal parts is probably due to the low nickel content.

Additional Comments:

I.

In connection with the letter (Reference 33-4-1-1) of April 4, 1945, from Commander Peile, it has been found that arsenic trioxide and benzyl thiocyanate have been used as inhibitors for the corrosion of brass. As soon as a supply of benzyl thiocyanate can be obtained we would like to test these inhibitors and also sodium selenite. We would like to obtain a supply of the various metals which come in contact with alcohol in the compasses, so that they can be tested with the various inhibitors. It is understood that these metals are 15 and 20 per cent nickel silver, naval brass, gun-metal and phosphor bronze.

II.

It is suggested that useful information regarding the causes of corrosion in compasses might be obtained if a member of the staff of these Laboratories were to visit the plant where the compasses are manufactured.

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