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August 5th, 1943.

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

Investigation No. 1469.

Examination of Anson II Aircraft Brake
Torque Plate.

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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:

In a letter dated June 29th, 1943 (File 938DD-2-5-(AMAE DAI)), A/C. A.L. Johnson, for Chief of the Air Staff, Department of National Defence, Air Service, Ottawa, Ontario, requested the examination of an Anson II aircraft brake torque plate which failed in service.

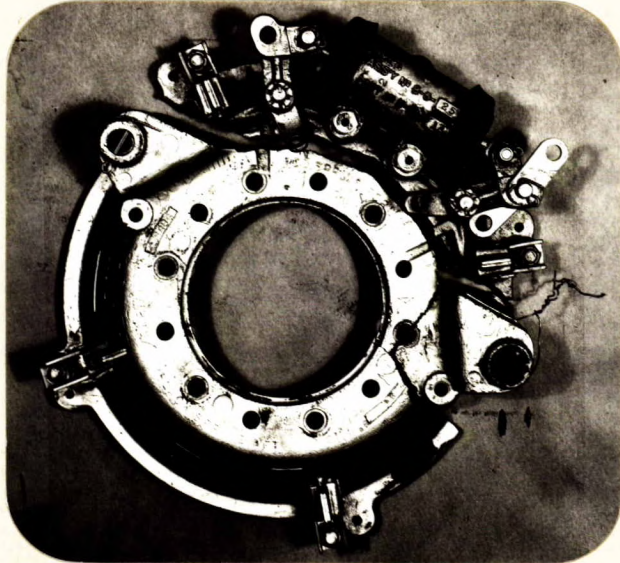
It was stated that a considerable number of similar failures have been reported and it has been suggested that the material is faulty. The material may be AC.195-T6, AC. 224T, or AC.225 T.

It was requested that an investigation be made to determine whether the submitted casting is defective or if there is any other metallurgical reason for the failure of this component.

Description of Samples:

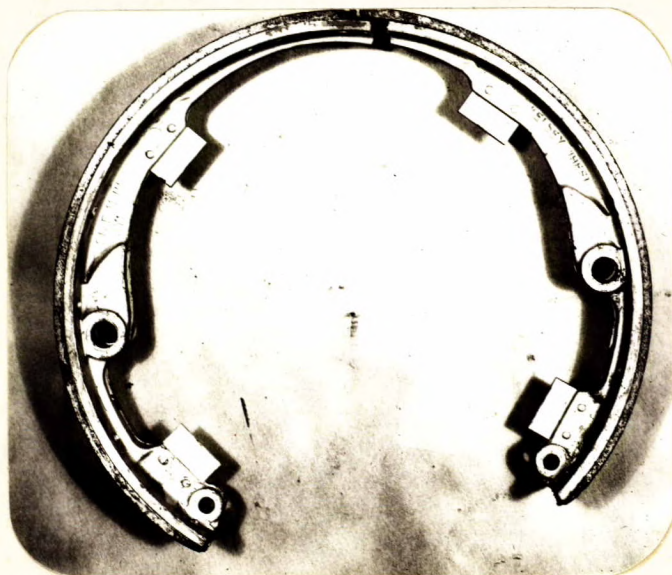
Figure 1 shows the broken brake torque plate -
as received.

Figure 1.



BRAKE TORQUE PLATE - "AS RECEIVED."
(Approximately $\frac{1}{4}$ size.)

Figure 2.



BRAKE SHOE - "AS RECEIVED."
(Approximately $\frac{1}{2}$ size.)

Chemical Analysis:

	<u>Brake Plate</u>	<u>Brake Shoe</u>
	- Per cent -	
Copper	- 1.34	4.26
Silicon	- 4.75	2.99
Iron	- 0.57	0.92
Magnesium	- 0.45	None detected.
Manganese	- 0.06	0.03
Titanium	- 0.16	0.14
Nickel	- 0.02	0.09
Zinc	- Trace	Faint trace.
Chromium	- None detected.	None detected.

Nominal compositions of similar alloys of the
Aluminum Company of Canada:

	<u>AC-125</u>	<u>AC-224</u>
	- Per cent -	
Copper	- 1.25	4.5
Silicon	- 5.0	3.0
Magnesium	- 0.5	-

MECHANICAL PROPERTIES:

Tensile Tests -

Tensile tests were carried out on a Hounsfield tensometer, which permits the testing of very small test specimens obtained from castings, forgings etc.

The specimens were cut out from different locations of the broken brake torque plate.

The dimensions of the machined test specimens were:

diameter - 0.158 inch
gauge length - 0.586 inch.

Following results were obtained:

<u>Sample No.</u>	<u>Ultimate Tensile Strength, p.s.i.</u>	<u>Elongation, Per cent</u>
1	- 27,500	1.5
2	- 29,500	2.0
3	- 27,000	1.5
4 ^o	- 36,250	3.5

^o Sample No. 4 was cut out from a thinner section of the casting.

(Mechanical Properties, cont'd) -

Tensile Tests, cont'd -

Typical values for AC-125 alloy as given by the Aluminum Company of Canada:

	<u>Ultimate Tensile Strength, p.s.i.</u>	<u>Elongation</u>	<u>Brinell Hardness</u> (500 kg./10mm.)
AC.125-W	- 30,000	5.0	60
AC.125-T22	- 35,000	3.0	80
AC.125-T34	- 39,000	1.0	85
AC.125-T43	- 28,000	1.5	60

Hardness Tests -

The hardness was determined by the Vickers method, using a 10-kilogram load.

Brake torque plate - 95-103 V.H.N.
Brake shoe - 90 V.H.N.

Microscopic Examination:

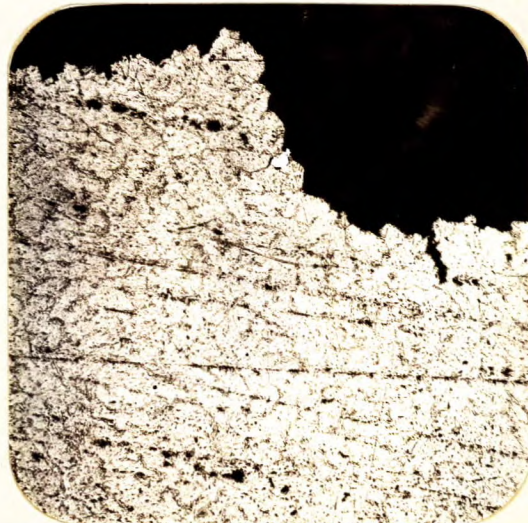
Figures 3 and 4 show the microstructure of cross-sections through the fractured parts of the castings.

Figure 3.



X100, unetched.

Figure 4.



X100, Keller's etch.

DISCUSSION OF RESULTS:

The chemical analysis revealed that the brake torque plate was made from AC-125 aluminium alloy, the brake shoe from AC-224 aluminium alloy.

Tensile results can be considered only as comparative as the specimens were cut out directly from the casting and did not conform to the dimensions of the standard test bar.

Microscopic examination showed no metallurgical defects (segregation, impurities, inclusions, corrosion, etc.).

The failures were probably due to mechanical over-stressing or improper design.

Conclusions:

The material was found to be satisfactory and no metallurgical reason for the defects was ascertained.

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JWM:MC:LB.