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O T T A W A March 21st, 1944.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1609.

Examination of Two Cornell Aircraft Landing Gear Springs.

(Copy No. 10.)

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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Source of Material and Object of Investigation

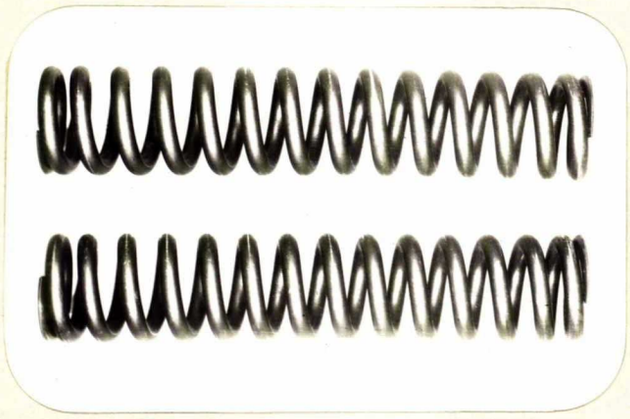
On March 6th, 1944, Mr. W.J. Cox, of the Structures Laboratory, Division of Mechanical Engineering, National Research Council, Ottawa, Ontario, submitted for examination two coil springs from the landing gear of a Cornell aircraft.

In a letter from Mr. Cox, dated March 8th, 1944, (File No. 312-N-1-193), it was stated that in drop tests carried out at the National Research Council's laboratories, on the first test the springs functioned satisfactorily but in subsequent drop tests the oleo legs did not behave properly. The parts were then taken apart but no damage was observed. It was suspected that possibly the springs may have been over-worked in the first series of tests and that their properties had changed, although the free length of the springs was found to be almost the same. It was requested that the springs be tested to the specification given in the Fleet Aircraft Limited's Drawing No. 61107.

Macro-Examination:

Figure 1 is a photograph illustrating the type of spring examined.

Figure 1.



SPRINGS "AS RECEIVED".
(Approximately 1/3 actual size)

Chemical Analysis:

One of the springs was annealed and then sampled for chemical analysis. The following results were obtained:

		Per Cent	
		SAE 9255 Specification	Found
Carbon	-	0.50-0.60	0.62
Manganese	-	0.60-0.90	0.77
Silicon	-	1.80-2.20	1.94
Phosphorus	-	0.040 max.	0.005
Sulphur	-	0.050 max.	0.024
Nickel	-	--	N.d.
Chromium	-	--	N.d.
Vanadium	-	--	N.d.
Molybdenum	-	--	N.d.

N.d. = None detected.

Mechanical Properties:

	PORT SPRING	STARBOARD SPRING
Free height, as received, inches -	10.67	10.88
Free height, as specified, inches -	10.75 ± 1/16	
Load at compressed length of 6½ inches, pounds -	1490	1558
Specified load at compressed length of 6½ inches, pounds -	1460 ± 80	
Height fully compressed, inches -	5.58	5.64
Length after being fully compressed, inches -	10.64	10.84
Permanent set after bottoming, inches -	0.03	0.04

Hardness Tests:

Rockwell hardness tests made on the two springs gave hardness values of 50, "C" scale.

Microscopic Examination:

Specimens were cut from one of the springs, mounted in bakelite, polished, and examined under the microscope in the unetched condition. The steel was found to be fairly clean. The steel was then etched in a solution of 2 per cent nitric acid in alcohol and re-examined. Figures 1 and 2 are photomicrographs, at X100 and X1000 magnification respectively, showing the nital-etched structure of the steel. This structure consists of tempered martensite. Slight decarburization was observed on the outer surface of the spring, measuring approximately 0.001 inch in depth.

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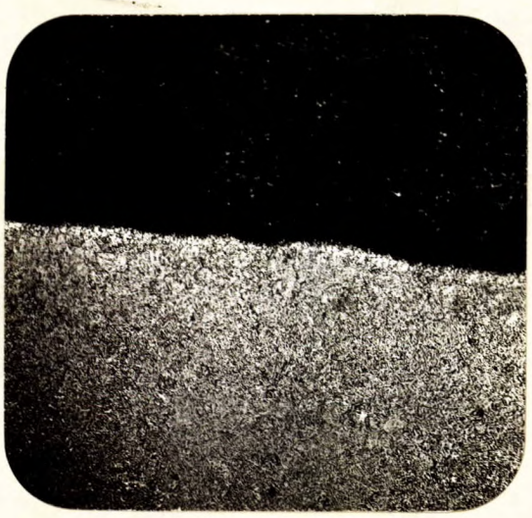
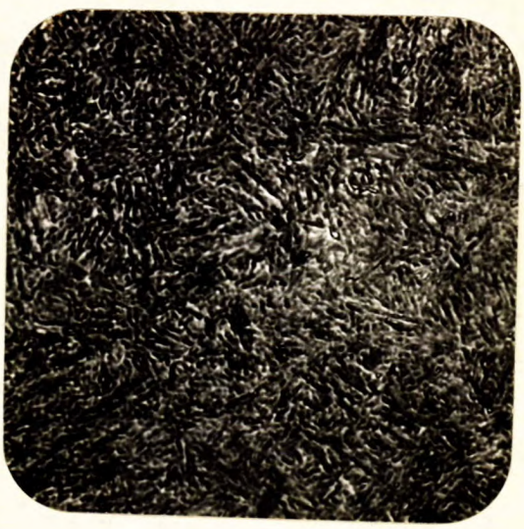
(Microscopic Examination, cont'd) -

Figure 2.



X100, etched in
2 per cent nital.

Figure 3.



X1000, etched in
2 per cent nital.

Remarks:

With the exception of the carbon content, which was slightly high, the composition of the steel used in these springs was within the limits specified for SAE 9255 steel. The springs were found to have been properly heat-treated to a hardness value within the range given in the specification.

The steel springs submitted had the specified mechanical properties. The slight decarburization observed, while it cannot be considered to be serious, might possibly lower the fatigue strength.

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