O T T A W A May 12th, 1942.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1216.

Kinking of Aircraft Target Towing Cable.

(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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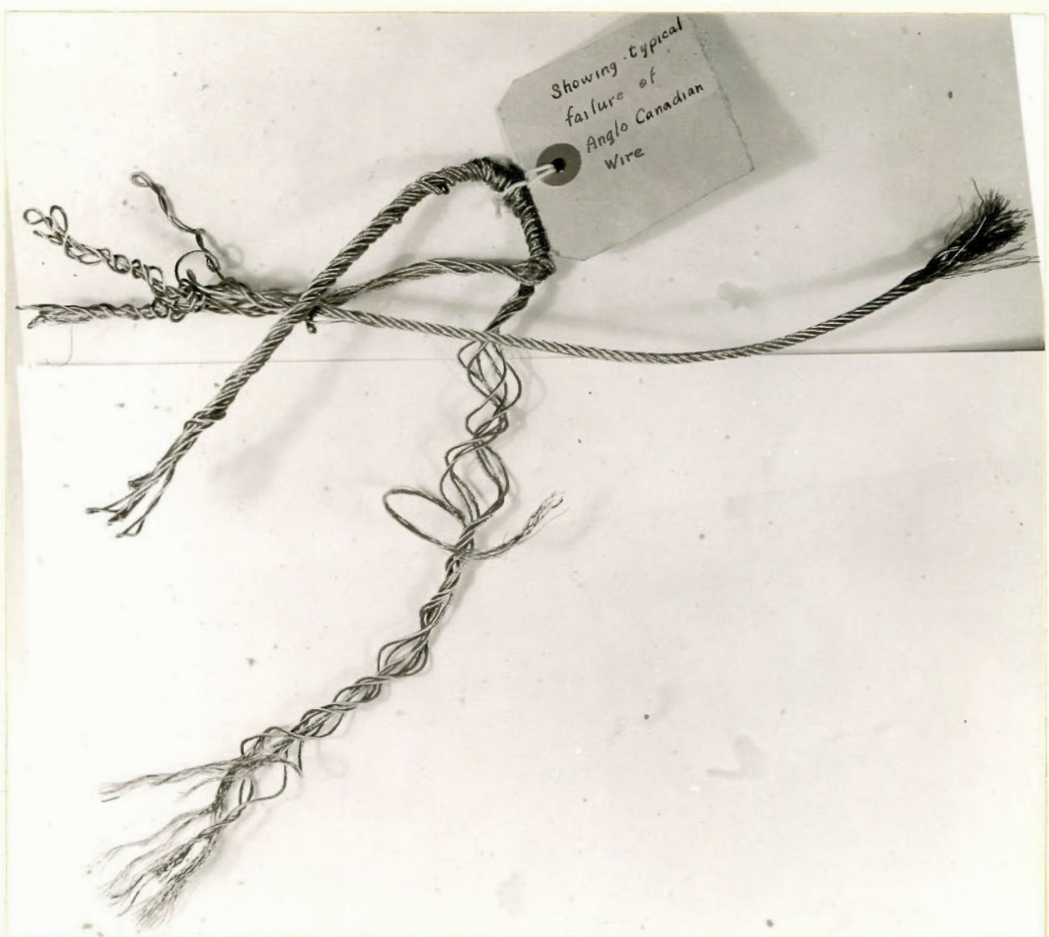
Origin of Request:

On April 29th, 1942, Squadron Leader A. J. Smith, of the Department of National Defence (Air Services), Ottawa, Ontario, personally submitted three samples of towing cable, one of which had been badly kinked in service. It was requested that the material be examined to find out any differences between the satisfactory and unsatisfactory cable.

Appearance of Cable:

Figure 1 shows the kinked cable, hereinafter called Cable A.

Figure 1.



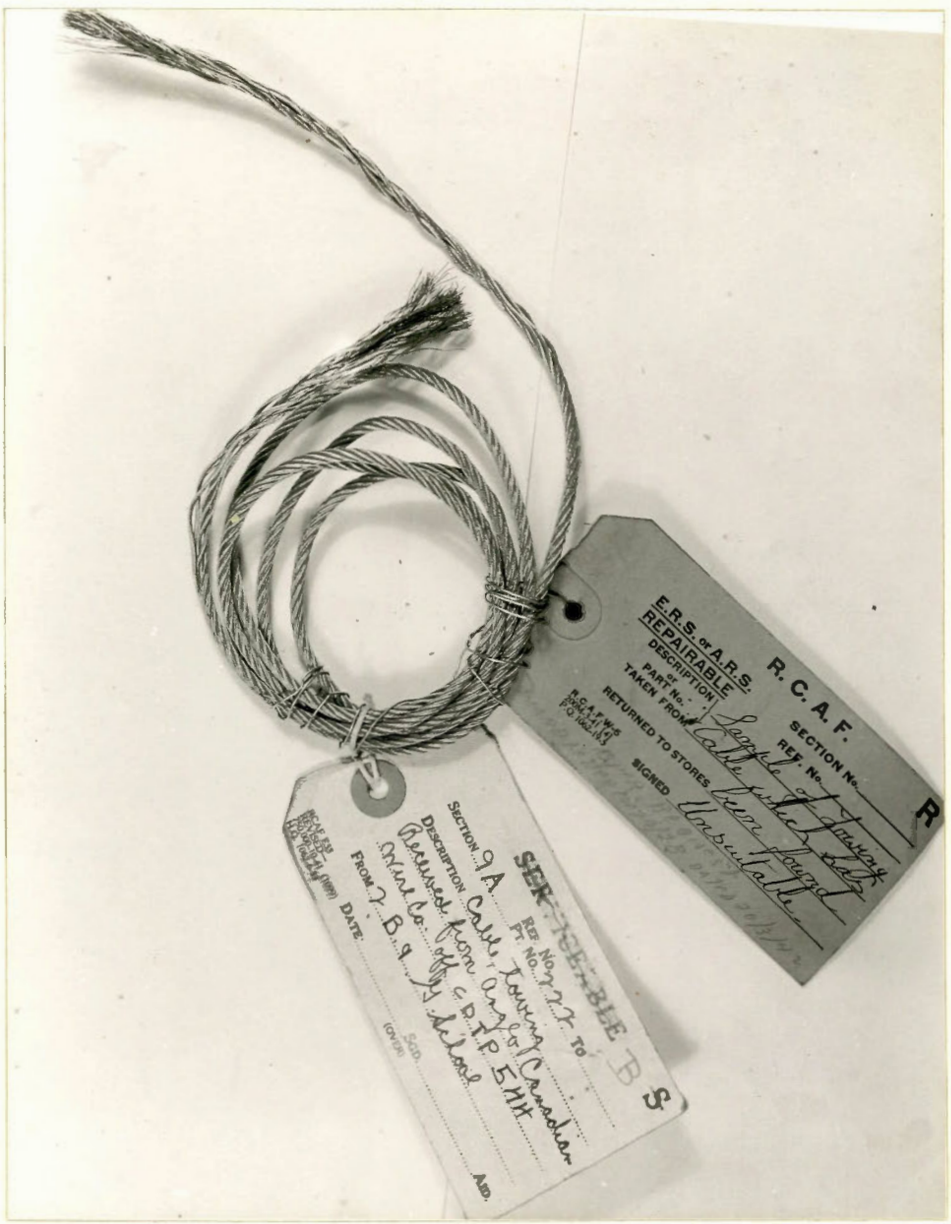
KINKED CABLE (A).

(Continued on next page)

(Appearance of Cable, cont'd) -

Figure 2 shows a coil of Cable B as received. Note that these strands have been separated in order to show that preforming was done on the wire before it was wound.

Figure 2.



COIL OF CABLE B, AS RECEIVED.

(Continued on next page)

(Appearance of Cable, cont'd) -

Figure 3 shows the cable (C) which has performed satisfactorily.

Figure 3.

SATISFACTORY CABLE (C).

Winding:

Each cable consisted of seven strands, each wound with twelve wires wrapped on a core of seven wires. All wires measured 0.008 to 0.009 inch diameter.

Tensile Tests:

Short sections, about 6 inches long, were mounted in Woods' metal and pulled apart. Cable A broke at 1,900 pounds, with 2 strands snapping. Cable B broke at 2,050 pounds, with 4 strands snapping. Cable C broke at 2,100 pounds, with 4 strands snapping.

Flexure Test:

In order to see the relative amount of cold work that each cable was capable of, a bend test was performed on the wires making up those strands which snapped in the tensile test. Each wire was held in a vice and given repeated reversal 90° bends, with the following results:

Flexure Tests.

	Cable A	Cable B	Cable C
Number of Tests made -	15	19	14
Average number of reversals before breaking -	4.9	5.4	4.4
Standard deviation -	1.53	1.54	1.2

From the above results it would seem that the wires on all cables were very similar.

Microstructure:

The structure of all three cable samples showed a very clean metal which had been cold worked. No difference that may be called significant was found between the three cables, although Cable A appeared to have a lesser amount of cold work. The difference between Cable A and the others,

(Microstructure, cont'd) -

however, was so slight that such a difference might occur between good cables.

Hardness:

All cables gave hardness numbers between 320 and 340 Vickers.

Chemical Analysis:

		- PER CENT -		
		Cable A	Cable B	Cable C
Carbon	-	0.71	0.63	0.71
Manganese	-	0.61	0.66	0.58
Silicon	-	0.15	0.22	0.31
Phosphorus	-	0.029	0.015	0.025
Sulphur	-	0.030	0.033	0.027
Nickel	-	Trace	Trace	Trace
Chromium	-	0.01	0.01	0.04
Molybdenum	-	Nil	Nil	Nil

Conclusions:

The kinking characteristic of Cable A cannot be traced to any difference in metal. It may be tentatively assumed, therefore, that the kink was due either to improper handling of the cable or to some difference in the stresses set up in the wire during the winding operation. The tighter the strands cling to each other the less chance there is for one to slide over the other and start the formation of a kink. It is understood that this information will serve to eliminate the question of variation in metal and that further investigation of the mechanical history of the cable will be carried out by the Air Services, Department of National Defence.

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