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TENSILE STRENGTH TESTS OF FOURDRINIER WIRE STRANDS BEFORE AND AFTER WEAVING

by

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PHYSICAL METALLURGY DIVISION

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SUMMARY OF RESULTS

Fourdrinier warp wires, in both the woven and the unwoven condition, were tested in tension.

Profile measurements on woven warp wires from several standard-mesh cloths indicated that the cross-sectional area of the warps at the top knuckles is reduced during weaving.

The tensile strength of unwoven warp strands and that of woven wire cloth are essentially equal when allowance is made for the reduced warp section at the top knuckles of the cloth.

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(2 tables, 1 illus.)

INTRODUCTION

In connection with the Fourdrinier Wire Research Project of the Physical Metallurgy Division, fourdrinier warp wires, in both the woven and the unwoven condition, were tested in tension.

Previous tests had shown that the tensile strength of woven wire cloth was considerably lower than that of the wire strands used to weave the cloth. The purpose of the present work was to attempt to explain this difference.

PREPARATION OF WIRE SAMPLES

A sample of fourdrinier wire, consisting partly of 65 x 48 mesh woven cloth and partly of unwoven warps, was obtained from the Capital Wire Cloth and Manufacturing Company Limited, Ottawa, Ontario. From this sample, tensile test pieces of both the wire cloth and the warp strands used to weave the cloth, could be obtained.

TENSILE TESTS

The tensile tests on the wire cloth and on the wire strands were performed by the Pulp and Paper Research Institute of Canada, Montreal, and the results are given in Table 1.

Examination of the broken wire cloth test pieces showed that each warp wire failed at a top knuckle where the warp is bent sharply around the shute during weaving. It was necessary to measure the cross-sectional area of the warp wires at this point, to determine the tensile strength of the woven warps.

CROSS-SECTIONAL MEASUREMENTS OF WOVEN AND UNWOVEN WARP WIRES

A typical warp wire was stripped from an unstressed sample of cloth and the warp profile was projected on a screen with an

optical comparator. Measurements on the profiles of several knuckles indicated that the bottom knuckles were of nominal diameter but that the top-knuckle diameter was reduced by weaving. A micro-section of several top knuckles indicated that the wires were essentially round after weaving. The reduced cross-sectional area of the top knuckles was calculated to be about 14% less than that of the original wire.

The diameter of the unwoven warp wires was measured with a micrometer and the calculated cross-sectional area was used to determine the tensile strength of the strands.

In addition to the measurements made on the 65 x 48 mesh wire, warp wires from 63 x 48 mesh and 60 x 44 mesh wire cloth were examined to determine the effect of weaving on the warps of the different meshes (see Table 2). The reduction of the cross-sectional area of the top knuckles due to weaving 63 x 48 mesh wire cloth and 60 x 44 mesh wire cloth, was calculated to be 16% and 15% respectively.

DISCUSSION

Table 1 shows that the tensile strength of the woven wire cloth is comparable with that of the single warp strands when the reduced top knuckle diameter is considered in calculating the tensile strength of the wire cloth.

The difference in ductility between the woven and the unwoven warps may be accounted for by the complex stress distribution in stressed woven wire cloth, where only part of the warp length is parallel to the tension force.

CONCLUSIONS

The tensile strength of fourdrinier warp wire strands and of

wire cloth are essentially equal when reduction of area of the warp top knuckles, due to weaving the cloth, is considered.

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(Tables 1 and 2 follow,
on pages 4 and 5.)

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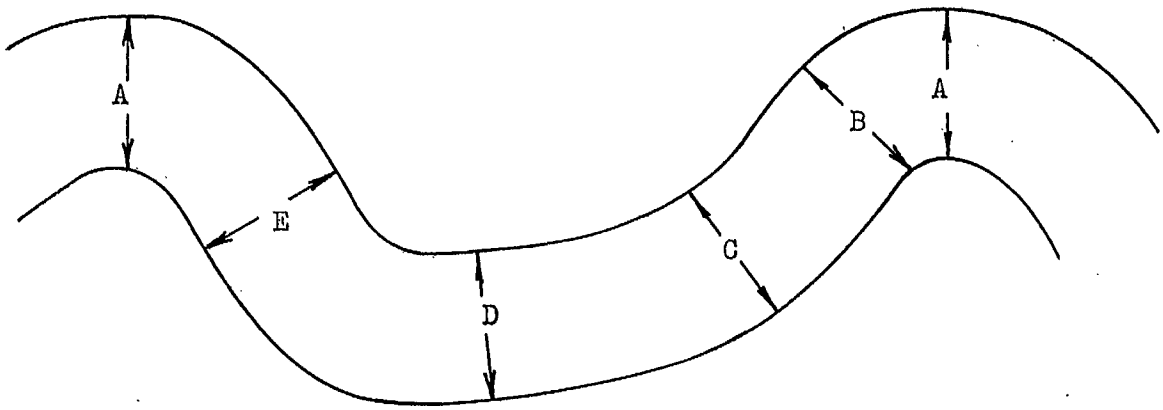
TABLE 1

Tensile Strength of Wire Cloth Samples and of Warp Strands Used in Weaving the Cloth

TEST 1		TEST 2	
Tensile Strength, psi	Elongation, %	Tensile Strength, psi	Elongation, %
Wire Cloth Samples		Wire Cloth Samples	
65,300	13	70,200	18
73,000	21	69,700	17.5
Single Warp Strands		Single Warp Strands	
71,500	57	69,900	61
71,100	60	72,300	60
71,500	61	70,700	60
72,300	58	69,500	59
69,500	44	71,900	58
70,300	58	71,100	58
71,100	60	71,900	57
71,100	64	71,900	58
70,700	62	70,700	62
Mean 71,000	57	71,100	59

TABLE 2

Diameter Measurements of Warp Wires from Various Wire Cloth Meshes



WARP
PROFILE

Mesh	A, in.	B, in.	C, in.	D,* in.	E, in.
65 x 48	.0075	.0074	.0077	.0080	.0080
63 x 48	.0078	.0078	.0081	.0085	.0084
60 x 44	.0085	.0085	.0088	.0090	.0089

* Measurement considered to be nominal diameter.

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