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TENSILE PROPERTIES OF NEW FOURDRINIER WIRE, 63/56 FLAT WARP AND 68/56 ROUND WARP, FROM CAPITAL WIRE CLOTH AND MANUFACTURING COMPANY LIMITED

by

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PHYSICAL METALLURGY DIVISION

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SUMMARY OF RESULTS

Strips of new wire cloth were tested in tension. The tensile specimens were taken from the samples provided by Capital Wire Cloth and Manufacturing Company Limited, Ottawa, Ontario.

The results indicated that the standard round warp wire (68/56 mesh) was intrinsically stronger than the flattened warp wire (63/56 mesh) by approximately sixteen per cent, in terms of pounds per linear inch of woven wire mesh. The average elongation of the round warp wire was approximately twenty-three per cent greater than the average elongation of the flattened warp wire.

The tensile strength of the wire cloth specimens was approximately constant for the three samples of each wire cloth tested.

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INTRODUCTION

On January 18, 1963, Capital Wire Cloth and Manufacturing Company Limited, Ottawa, Ontario, submitted representative samples of two types of unused fourdrinier wire cloth. The first type contained the conventional round warp wire (68/56 mesh) the other contained a flattened warp wire (63/56 mesh), (Figure 1).

The investigation was prompted by the premature failure of a fourdrinier wire belt of the flattened type in the E.B. Eddy mill in Hull, Quebec. This belt had shown a tendency to ripple, and a high suction box vacuum. Belt tension has been increased progressively to overcome the ripple, and after considerable stretching, the belt failed.

In a discussion with Mr. Edward Unwin, Vice-President of Engineering, Capital Wire Cloth and Manufacturing Company Limited, it was agreed that the two types of wire cloth should be comparatively tested and examined to try to determine the cause of the wire failure.

PREPARATION OF THE TENSILE TEST SPECIMENS

Three 12-inch samples of each type of wire cloth were prepared. Each sample consisted of a one inch width of solid woven mesh. Five individual warp wires had been stripped from each side of the 1 inch sample for edge preservation during tensile testing (Figure 2).

CROSS-SECTIONAL AREA MEASUREMENTS ON THE INDIVIDUAL WARP WIRES

Before determining the tensile strength of the wire cloth, it was necessary to measure the cross-sectional area of each type of wire.

The relationship used in the calculation of the cross-sectional area was

$$A = \frac{W}{DL}$$

where A = area, square inches
W = weight of specimen, pounds
D = density of Type C phosphor-bronze, (0.318 lb per cu in.)
and L = length of specimen, inches.

For each determination, a given length of individual warp wires was stripped from the cloth and subsequently weighed on a balance. The data are presented in Table 1. These calculations are slightly in error in that no allowance has been made for the crimp in the wires. Thus, these are actually longer than stated, and consequently, the cross-sectional area of the wire will be slightly less than calculated.

TENSILE TESTS

The wire cloth strips were tested in tension on a Hounsfield Tensometer machine. A wind-on method of gripping was used as wire mesh specimens are normally very prone to tear at the grips. Further information concerning the design and operation of the tensometer can be obtained by consulting the catalogue: Hounsfield Testing Machines and Equipment, Publication No. 143/48, Tensometer Limited, 81 Morland Road, Croydon, Surrey.

The results of the tensile testing are outlined in Table 2.

DISCUSSION

The ultimate tensile strength values given in Table 2 are actually slightly lower than they should be, since as mentioned previously, the actual cross-sectional area of the wire is less than calculated. This discrepancy is cancelled when the results are used on a relative basis to compare the intrinsic strength of the two types of wire, and, of course, the break load is not affected by this error.

The total elongation at failure of the flat wire cloth was considerably less than that of the round wire cloth (11.5% compared to 15%). It was also noticed that at fracture the flat wire cloth showed considerable curvature across the specimen. These may be related to the failure in the Eddy plant in that under tension the flat wire belt may have distorted, and in tightening the belt in an attempt to overcome this, the operators may have exceeded the permissible elongation, which, as shown, is lower than with the normal round wire.

A comparison of Figures 3 and 4 illustrate that the crimping in the round 68/56 cloth is more severe than that of the 63/56 cloth, providing a more efficient locking mechanism in the woven wire.

The open area per linear inch of woven cloth for the 68/56 and 63/56 materials is calculated by the plant to be 21.77 per cent and 20.69 per cent respectively. This would indicate that the drainage on the fourdrinier wire belt should be five per cent more effective for the round 68/56 mesh cloth. However, it was reported that the vacuum box suction was much higher on the flat warp wire than the normal round warp. This may be accounted for by the relatively small difference in open area mentioned above, but is more likely due to geometrical factors in the mesh. Thus the flat bottomed wire would be expected to form a more effective seal over the holes of the vacuum box. Also, the holes in the mesh of the flattened wire tend to be only in the plane of the cloth, whereas, because of the shape of the round wire, the holes in the normal mesh have a three dimensional effect. Both of these factors would tend to increase the suction at the vacuum box for the flat wire.

CONCLUSIONS

The strength of the 68/56 mesh woven wire cloth is approximately sixteen per cent greater than that of the 63/56 mesh flat wire. Per linear inch of woven wire cloth, the average break load of the 68/56 mesh cloth is 206.5 pounds (68 warp wires/inch) compared to a value of 174 pounds (63 warp wires/inch) for the 63/56 mesh cloth. The elongation at failure is considerably less in the flat wire cloth (11.5% compared to 15%) and this cloth also distorted more under load.

TABLE 1

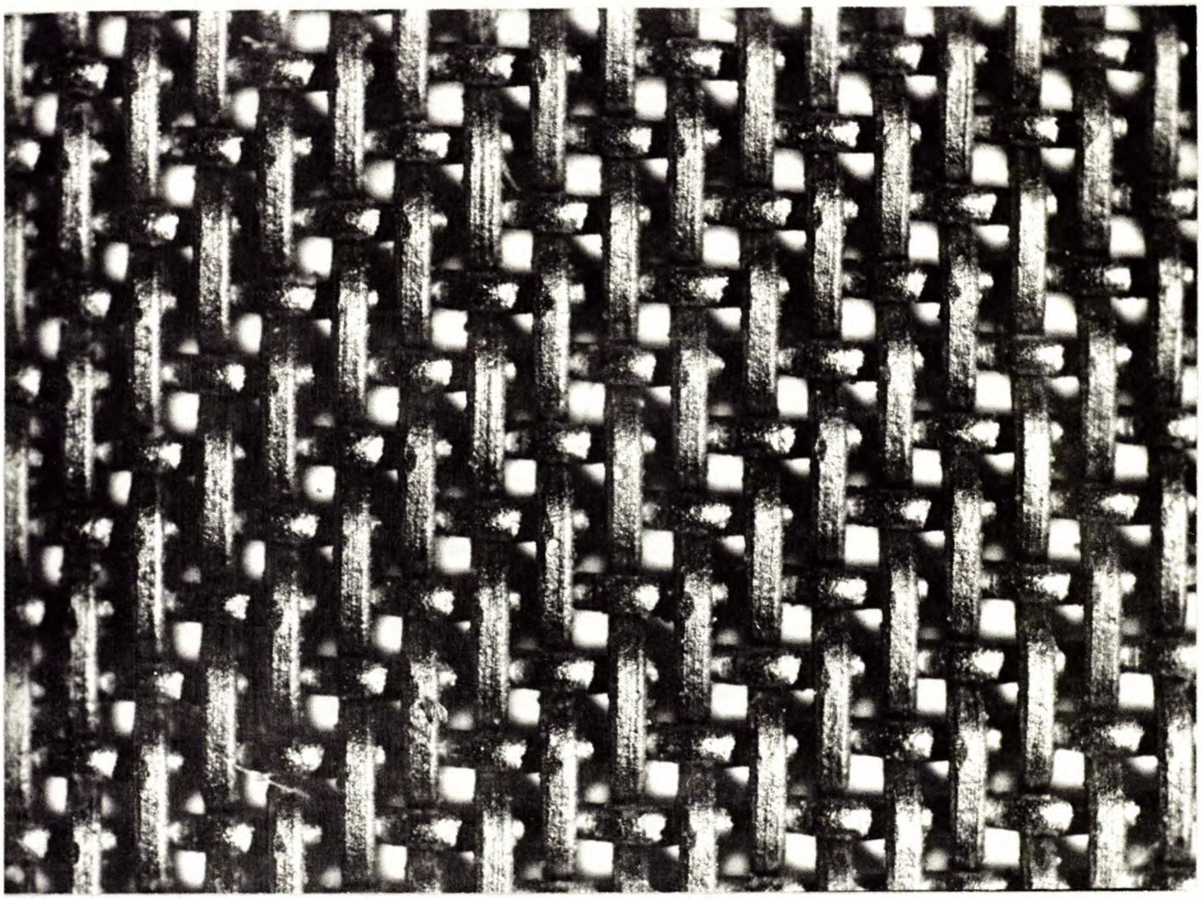
Cross-sectional Area of the Individual Warp Wires

Wire Type	Length in.	Weight lbs	Area in2
63/56	32.0	5.146×10^{-4}	5.06×10^{-5}
68/56	25.3	4.650×10^{-4}	5.81×10^{-5}

TABLE 2

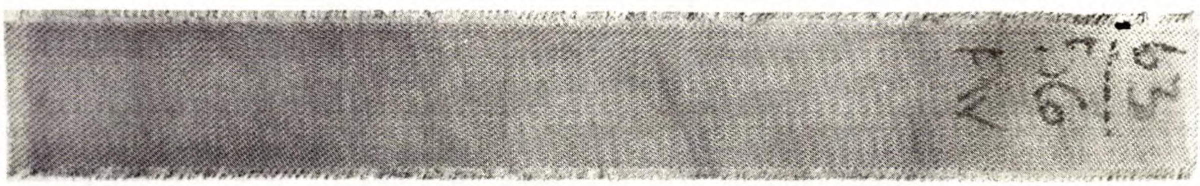
Tensile Properties of Strips of Wire Cloth

Wire Type	No. of Wires in Test Section	Total Cross-Sectional Area sq. in.	Break Load pounds	Ultimate Tensile Strength psi	Elongation % 2 in	Elongation % 4 in	Break Load (lb) per Linear Inch of Woven Wire
63/56	65	.0032175	170	52,836	13.0	13.0	
	66	.0032670	180	55,100	11.0	11.0	
	64	.0031680	180	56,820	11.0	11.0	
Averages			177	54,920	11.6	11.6	174.0
68/56	72	.003960	208	52,525	14.0	14.5	
	68	.003740	200	53,480	16.0	15.5	
	66	.003630	185	50,970	15.0	15.0	
Averages			198	52,325	15.0	15.0	206.5



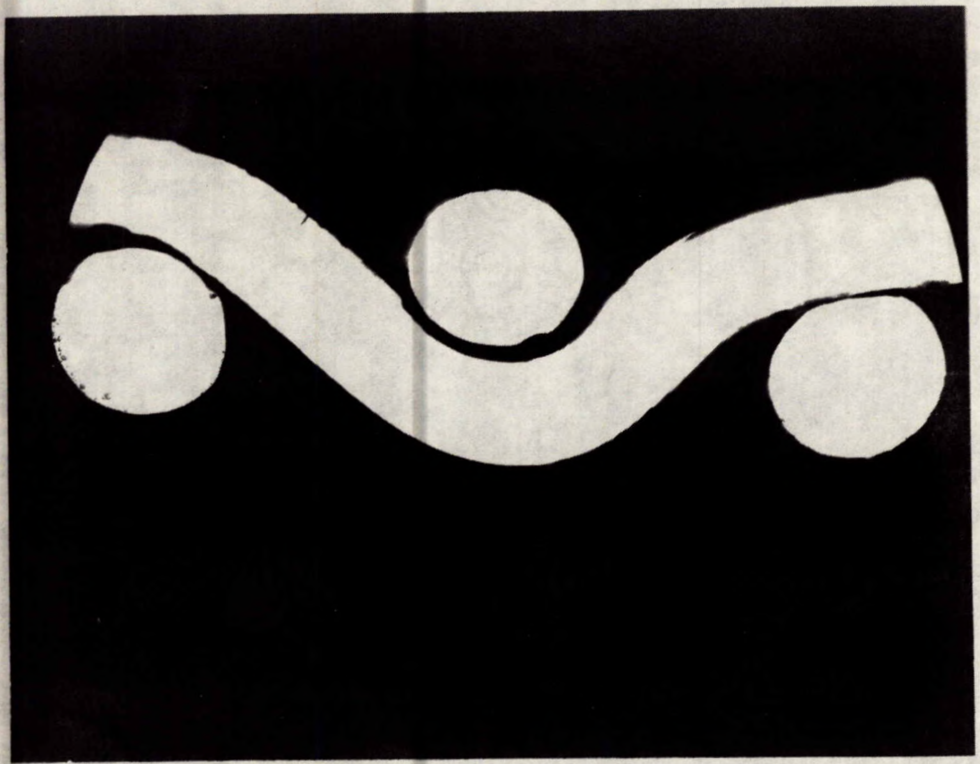
8X

Figure 1. Bottom view of 63/56 mesh wire cloth, illustrating the flattened warp wire.



1/2 size

Figure 2. View of tensile test specimen.



100X

Figure 3. Section of woven 68/56 mesh round wire cloth showing the nature of the crimp in the warp wire.

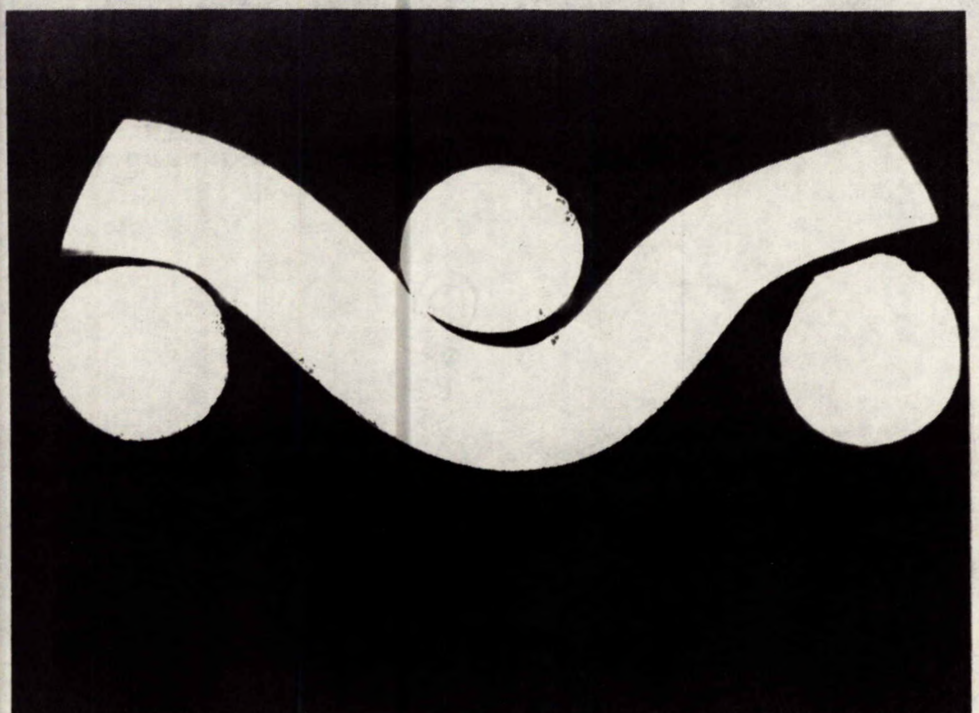


Figure 4. Section of woven 63/56 mesh flat wire cloth as above.