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NOTES ON THE RELATION OF THE CRIMP OF THE FILLING TO THE CONTRACTION IN WIDTH AFTER WEAVING[1]

In attempting to reproduce a piece of fabric, the designer must make a close examination of a number of details in order that he may give instructions to the weaver and finisher as to the general settings and treatments which will result in the kind of cloth desired.

Experience has shown that one of the most important considerations in this phase of the art of designing is to obtain exact information on the crimp of both the warp and the filling. These are needed to define the tension to be applied to the warp ends during weaving and the width of reed to be used, due consideration being given to the stretch or shrinkage in finishing.

It has been the practice in a number of factories and testing laboratories to report the desired width in the reed. This is obtained from the measurements of the finished width and the per cent crimp of the filling; for example, the finished width x 100 + per cent crimp = width in loom. Some dependence may be placed on this method where the original sample is unfinished. It is correct for certain types of cloths and may be nearly enough correct to be accepted, though it should never be used in designing fabrics where the width is altered during finishing. It is not the object of this report to cause abandonment of this practice, but to point out the necessity of accurate measurement[2] and the limits of its uses.

In carrying out one of its recent investigations on cotton fabrics, the Textile Section of the Bureau of Standards had occasion to weave 68 different pieces of experimental fabric. Each of the fabrics woven differed in some way from every other one, but in every case the width of the warp threads in the reed was the same, namely 31.3 in., resulting in the production of various weights of cloth in which there were marked differences in the widths of the woven fabrics and the crimp of both sets of threads. This afforded a good opportunity to study the relation between the crimp and the contraction,

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[2] A report is being prepared on the measurement of crimp.

the corresponding values of which are tabulated below. The last column is found by dividing the difference between the crimp and the contraction by the smaller of these two values.

Table 1

Relation between Filling Crimp and Width Contraction

No.	A Crimp of filling	B Width of woven cloth	C Contraction reed to cloth	A-C	Difference
	per cent	in.	per cent	per cent	per cent
1	2.7	30	4.2	-1.5	-55
2	2.8	30 3/8	3.0	- .2	- 7
3	2.9	30 5/8	2.2	+ .7	+32
4	3.0	30 1/4	3.4	- .4	-13
5	3.2	30 1/4	3.4	- .2	- 6
6	3.4	30	4.2	- .8	-24
7	3.7	30 1/8	3.8	- .1	- 3
8	3.7	30 1/4	3.4	+ .3	+ 9
9	3.8	30 1/4	3.4	+ .4	+12
10	3.8	30	4.2	- .4	-11
11	4.0	29 7/8	4.6	- .6	-15
12	4.0	30 1/4	3.4	+ .6	+18
13	4.1	30	4.2	- .1	- 2
14	4.3	29 7/8	4.6	- .3	- 7
15	4.4	29 3/4	5.0	- .6	-14
16	4.4	29 1/2	5.8	-1.4	-32
17	4.4	29 1/8	7.0	-2.6	-59
18	4.5	30	4.2	+ .3	+ 7
19	4.5	30	4.2	+ .3	+ 7
20	4.6	29 3/8	6.2	-1.6	-35
21	4.6	29 7/8	4.6	0	0
22	4.6	29 3/8	6.2	-1.6	-35
23	4.6	29 3/4	5.0	- .4	- 9
24	4.6	29 7/8	4.6	0	0
25	4.7	29 7/8	4.6	+ .1	+ 2
26	4.7	29 1/4	6.6	-1.9	-40
27	5.0	29 5/8	5.4	- .4	- 8
28	5.1	29 1/2	5.8	- .7	-14
29	5.1	29 7/16	6.0	- .9	-18
30	5.2	29 1/2	5.8	- .6	-12
31	5.3	29 3/8	6.2	- .9	-17
32	5.4	29 1/4	6.6	-1.2	-22
33	5.4	29 3/16	6.8	-1.4	-26
34	5.4	29 1/4	6.6	-1.2	-22
35	5.4	29 3/4	5.0	+ .4	+ 8
36	5.4	30	4.2	+1.2	+29
37	5.7	29 1/4	6.6	- .9	-16
38	5.7	29 1/8	7.0	-1.3	-23
39	5.8	29 1/8	7.0	-1.2	-21

No.	A Crimp of filling	B Width of woven cloth	C Contraction reed to cloth	A-C	Difference
	per cent	in.	per cent	per cent	per cent
40	5.8	29 1/8	7.0	-1.2	-21
41	6.0	29 3/8	6.2	- .2	- 3
42	6.1	29 5/8	5.4	- .7	+13
43	6.2	29	7.4	-1.2	-19
44	6.2	29	7.4	-1.2	-19
45	6.3	28 7/8	7.8	-1.5	-24
46	6.4	29 1/4	6.6	- .2	- 3
47	6.4	29	7.4	-1.0	-16
48	6.5	28 7/8	7.8	-1.3	-20
49	6.5	29 3/4	5.0	+1.5	+30
50	6.6	29 5/8	5.4	+1.2	+22
51	6.9	29 1/2	5.8	+1.1	+19
52	7.7	29 1/4	6.6	+1.1	+17
53	7.8	29 1/8	7.0	+ .8	+11
54	7.8	28 1/2	9.0	-1.2	-15
55	7.8	28 3/8	9.4	-1.6	-21
56	8.0	28 5/8	8.6	- .6	- 8
57	8.1	29 1/8	7.0	+1.1	+16
58	8.1	28 3/4	8.2	- .1	- 1
59	8.2	28 7/8	7.8	+ .4	+ 5
60	8.2	28 7/8	7.8	+ .4	+ 5
61	8.4	29 1/4	6.6	+1.8	+27
62	8.6	28 7/8	7.8	+ .8	+10
63	8.7	29	7.4	+1.3	+18
64	9.0	28 1/4	9.8	- .8	- 9
65	9.4	28 1/2	9.0	+ .4	+ 4
66	9.5	28 5/8	8.6	+ .9	+10
67	10.5	29	7.4	+3.1	+42
68	11.3	28 7/8	9.4	+1.9	+20

A study of the above table shows that while there is a general similarity between the crimp and the contraction, there are a number of marked exceptions. The fourth column shows that in 9 cases the difference is greater than 30 per cent, while in only 22 cases is it less than 10 per cent. In fact, the difference is more often over 20 per cent than under 10 per cent. In 41 cases the contraction is the larger, in 25 cases the crimp is the larger, while in 2 cases they are equal. The fact that the contraction had a slight tendency to be the greater in the fabrics used is shown on the plot of crimp against contraction by the slight elevation above a 45° angle of the straight line drawn through the points.

In order to determine whether the use of some other factor would result in a more regular relation, various combinations

of the warp and filling crimp were plotted against the contraction. The only one which showed even an approximate relation was a plot of contraction against the sum of warp and filling crimp. This resulted in a curve from which the individual points departed to about the same degree as in the curve shown here, and therefore is not shown.

There seems to be no regular relation between the crimp and the contraction. While the equality is more or less true, it should be used only with a realization of the amount of the errors involved.