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STRENGTHENING OF THE RAMIE TECHNOLOGY DEVELOPMENT CENTRE, CHANGSHA, HUNAN PROVINCE

DG/CPR/85/057 11-53/J13102

Appendices 2-24 "Experimental Results & Measurements"

to final report by Mr S W McMahon

Prepared for the Government of China by the

United Nations Development Organisation, acting

as executing agency for the United Nations

Development Programme

By Mr S W McMahon

Weaving Expert

Backstopping Officer: J-P Moll, Agro-Based Industries Branch

United Nations Industrial Development Organisation

Vienna

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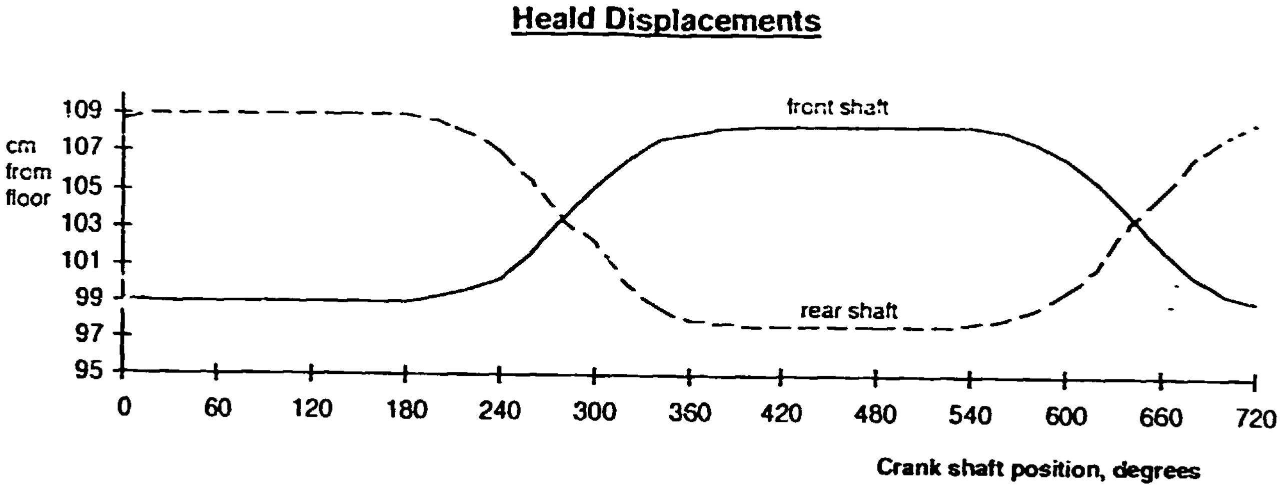
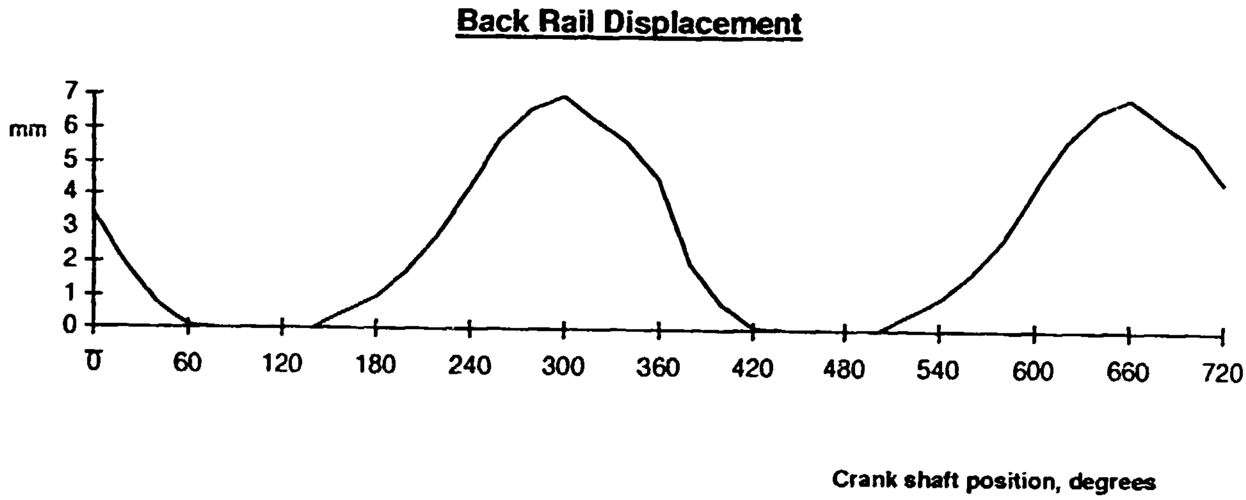
* The document has not been edited.

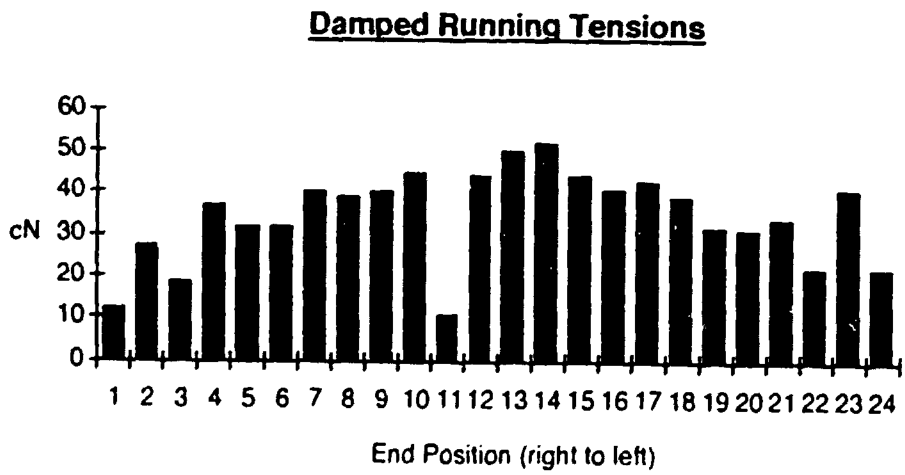
LIST OF APPENDICES

Appendix 2

Preliminary Measurements, Project 3







Excluding temple region

range 41
stdev(n-1) 9 1 (6)
mean 38 2(39 2)

Including temple region

range 41
stdev(n-1) 11 03
mean 34 6

Planned Experimental Variables, Project 3

SAMPLE	BACK RAIL HEIGHT, CM	HEALDS LEVEL TIMING, DEGREES	BACK RAIL CAM TIMING, DEGREES
1	7.5	270	270
2	7.5	270	330
3	7.5	290	290
4	7.5	310	310
5	10	310	310
6	10	290	290
7	10	270	330
8	10	270	270
9	12.5	270	270
10	12.5	270	330
11	12.5	290	290
12	12.5	310	310

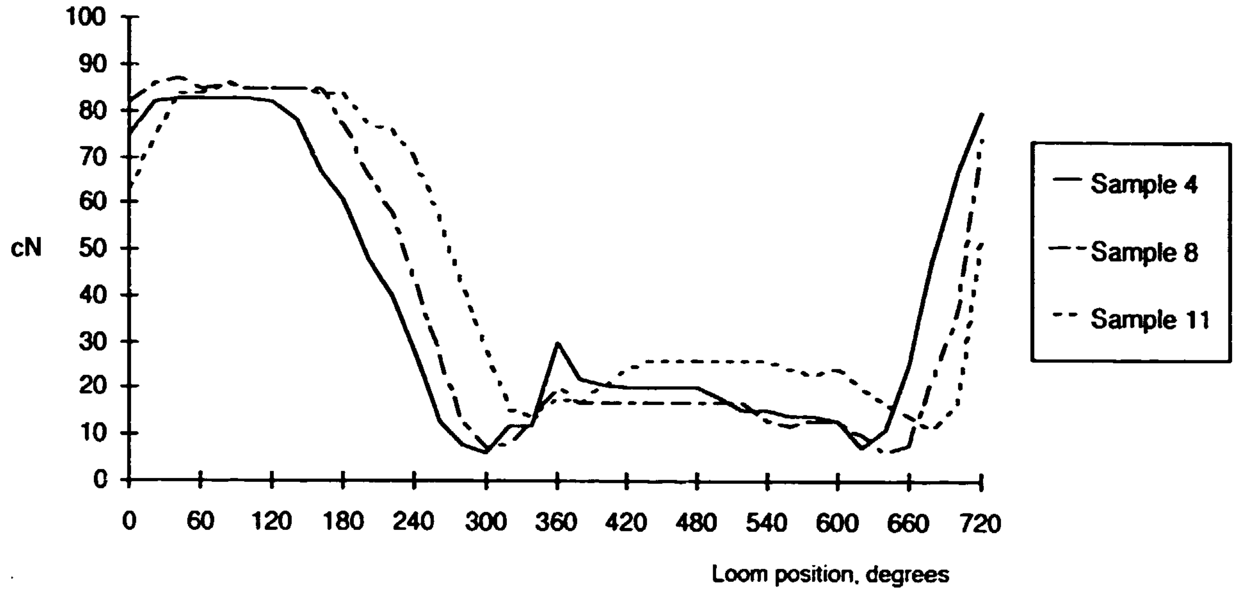
Actual Experimental Variables

SAMPLE	BACK RAIL HEIGHT, CM	HEALDS LEVEL TIMING, DEGREES	BACK RAIL CAM TIMING, DEGREES	WEIGHT POSITION
A	8.5	270	270	5
B	8.5	270	270	4
C	8.5	300	308	4
D	10	270	270	5
E	10	270	330	4
F	10	300	308	5
G	10	330	330	5
H	12	270	270	4
I	12	270	270	5
J	12	270	330	4
K	12	270	330	5
L	12	300	308	5
M	12	330	330	5

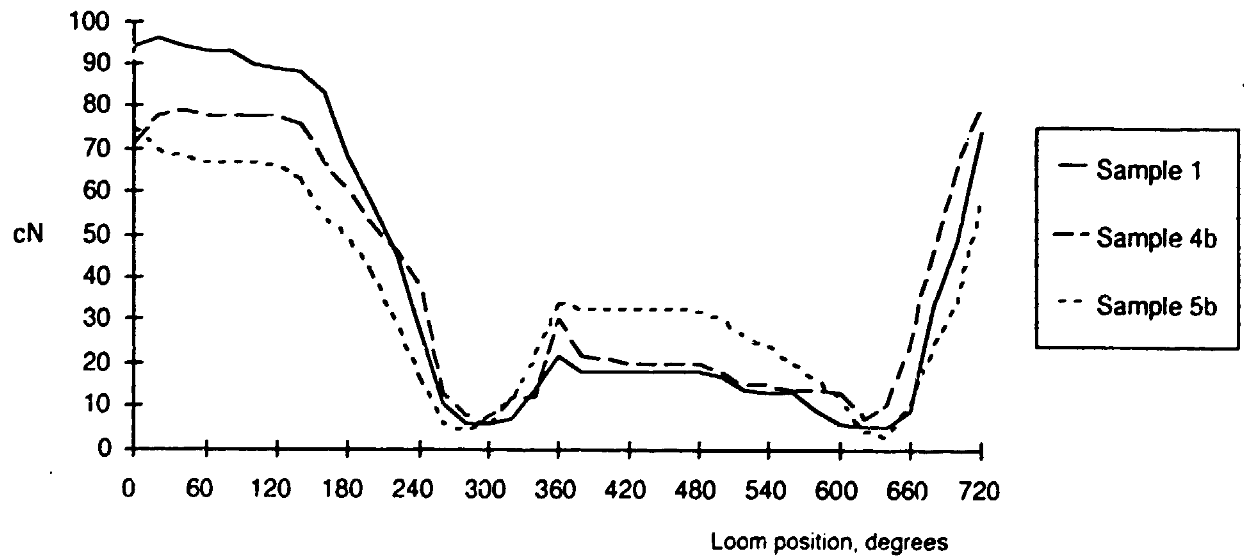
Appendix 5

The Effects of Loom Settings On Static Warp Tension, Project 3

Effect of Heald Level Timing

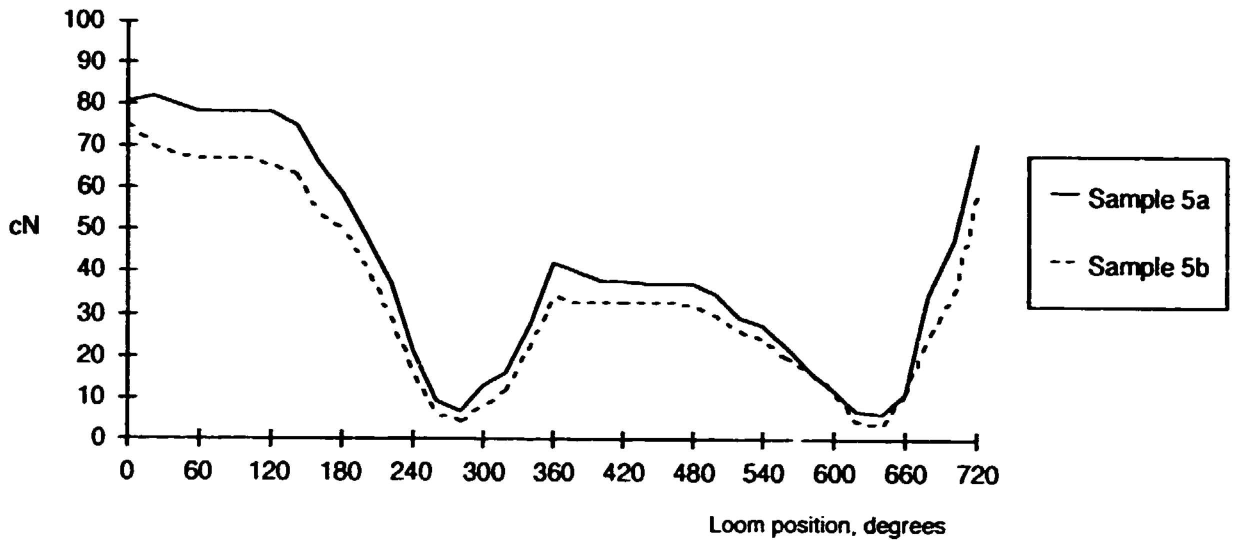


Effect of Backrest Height

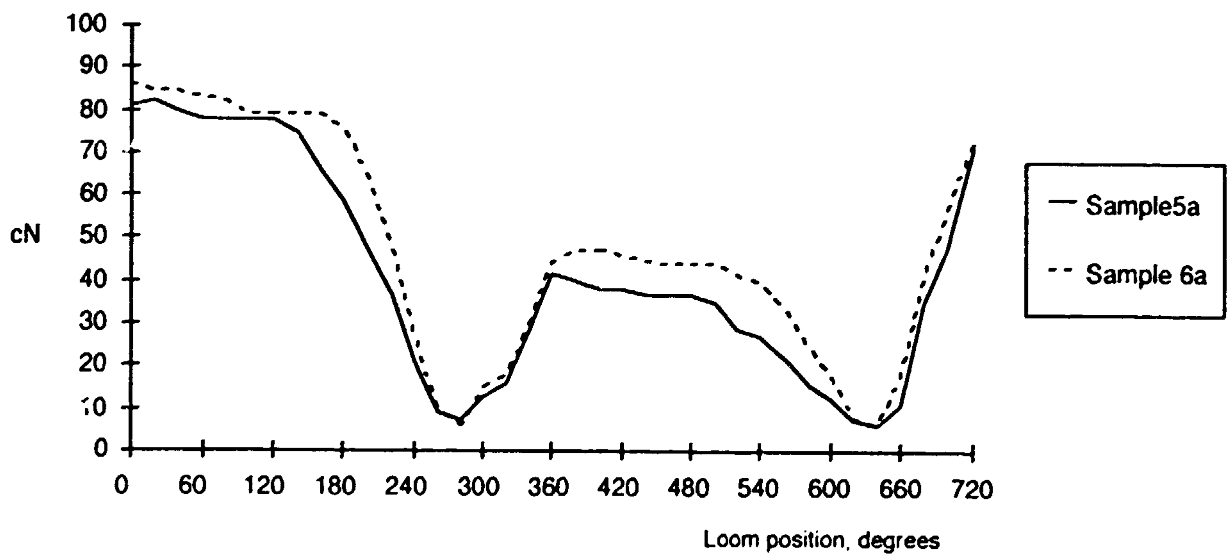


Appendix 5 continued

Effect of Tension Weight Setting



Effect of Late Back Rail Timing



Appendix 6

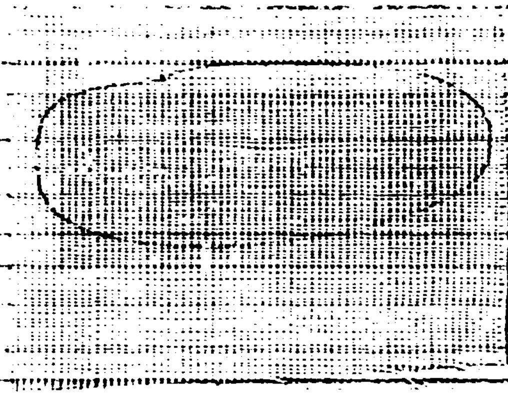
Table Of Results, Project 3

Sample Code	Backrest Setting	Healds Level	Back Rail Cam	Weight Setting	Shed Formation	Stitching Position	Warp Breaks			Cracks			Weaving Over	Reediness		Sample Length
							Break	Yarn	Crossed	Very minor	Minor	Major		Grey	Bleached	
A	8.5	270	270	5	4	1/2-5/8	5	2	2	Many	Many	4	1			1.56
B	8.5	270	270	4	3.75	1/3-1/2	5	1		Many	20+	2	3	2 (16.5)	2=(11)	1.62
C	8.5	300	308	4	4.5	1/2-3/4	5	1		Many	Many		2			1.6
D	10	270	270	5	2.8	1/3 - 1/2	4	1	1	2	2		1			3.05
E	10	270	330	4	3.5		3	5	1	4	4	1	1			3.06
F	10	300	308	5	3	1/3-1/2	1	2	1	2			2	6 (6.5)	5 (6)	1.52
G	10	330	330	5	3.75	1/3 -1/2	1	3	5	2						1.49
H	12	270	270	4	1.75		2	5	3	5						1.47
I	12	270	270	5	2		1	2	2	11				5 (7)	4 (8)	1.53
J	12	270	330	4	2	5/8 -3/4	4	3	1	11						3.03
K	12	270	330	5	2		2	1	1	6	3					1.55
L	12	300	308	5	2.375	1/3-1/2	2	1	3		3					1.54
M	12	330	330	5	3	1/3-1/2	3		1		4		1	7 (4.5)	7 (3)	1.51
O	7.5	270	270	4	5	5/8-3/4								1 (21)	1 (14)	0.28
ZhuZhou 1														3 (16)	2= (11)	
ZhuZhou 2														4 (12.5)	6= (3)	

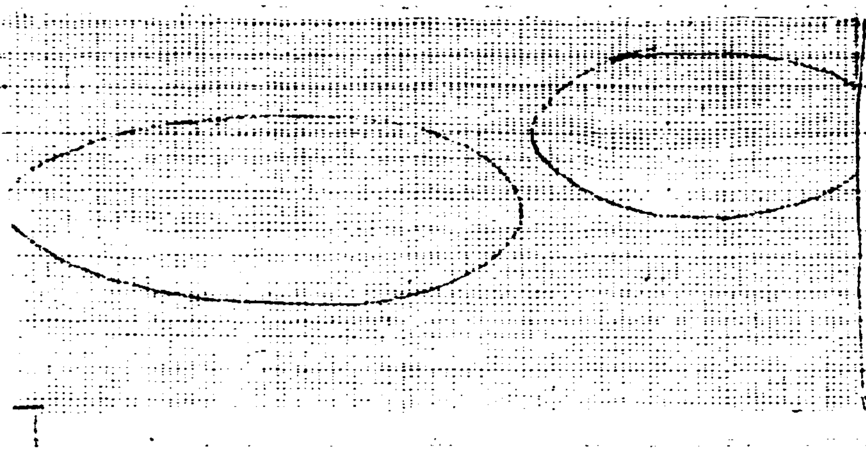
Appendix 7

Fabric Faults Caused By Clinging Ends, Project 3

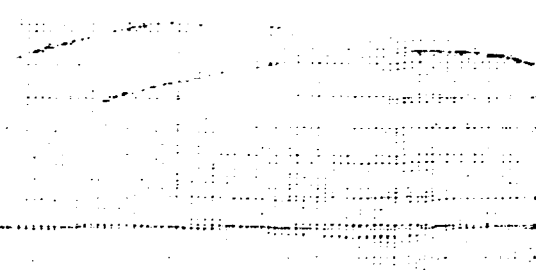
Minor crack, Sample K



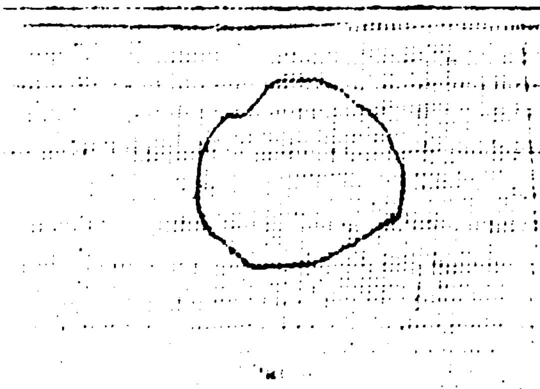
Cracks, Sample M



Worst crack, Sample E



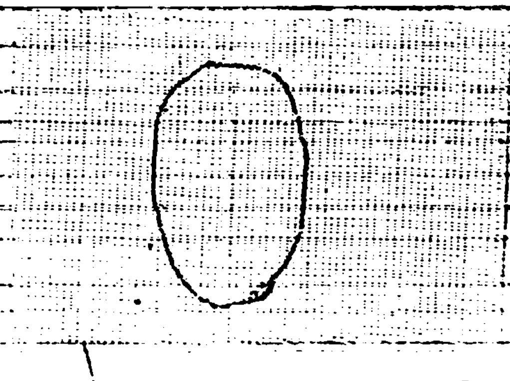
Weaving over, Sample M



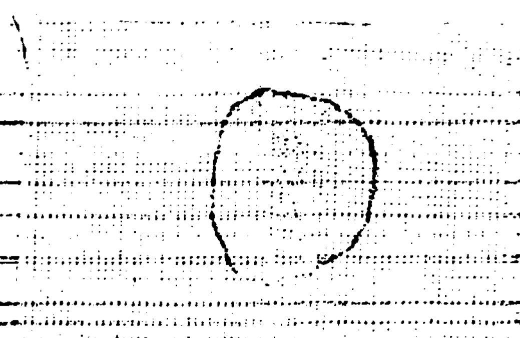
Appendix 8

Fabric Faults Caused By Persistently Clinging Ends, Project 3

Single end, repeated clinging



Multiple ends, repeated clinging



Appendix 9

Production Study, ZhuZhou Mill

Loom	Hour	Warp Break	Warp Break Yarn	Warp Break Crossed	Trim Warp	Lost End	Weft Break	Stop on Change	Other (mins)	Unweave (mins)	Mech (mins)	Rear shed Length	Heald Height
	1	2	1	3	1		1	13					rear high
241	2		1			1	1	7				14cm	front not
	3			2				8	10	25			checked
	1	3	2	1		1	2	10		10			both high
242	2	1		1				12				12.5cm	on left
	3	3		1			1	7	15	30			hand side
	1	3		2	1		2	10					rear high
243	2	1	1					8				10cm	front not
	3	2					1	6		2	6		checked
	1		1	2	1	1	1	11			10		rear slightly
244	2	2	1	2		1		11				11cm	high
	3	1		2			1	8			25		
Totals		18	7	16	3	4	10	111	25	67	41		

Total short stoppages 169 Total minutes lost for long stoppages 133

Appendix 10

Summary of Production Studies Conducted by ZhuZhou Mill Technologists During Spring 1994

Cause	Occurences	Equivalent Classification Appendix 6
Hairs	2	Warp break
Selvedge Break		
Thick or thin places	14	Warp beak or yarn fault
Loose knots	7	
Degumming fault	2	Yarn fault
Long tailed knots	2	
Crossed ends	8	Crossed ends
Lost ends	4	Lost ends
Weft break, slub	2	Weft break
Weft break, bad knot	1	
Fly accumulation*	4	No equivalence
Weaver	1	

* Warp breaks occuring due to fly accumulating in front of lease rods.

Appendix II

Loom Settings Recorded At ZhuZhou Mill, March 1994

Loom Number	Back rail height, mm		Stop motion height, mm		Distance Back rail to stop motion, mm		Weight position		Healds level distance, mm	Difference in treadle lever position, mm	Shed height error, mm
	Left side	Right side	Left	Right	Left	Right	Left	Right			
361	75	70	215	219	310	310	None	None			
362	73	72	220	216	320	325	None	None			
363	74	75	212	215	335	325	2	None			
364	73	74	216	214	335	335	4	1			
365	74	75	214	213	335	330	5	4			
366	75	75	223	223	330	325	9	7			
367	75	72	216	215	330	330	None	None			
368	75	75	221	220	323	334	0	0			
369	74	75	215	216	330	321	None	None	230	-	1
370	74	73	218	219	332	330	5	None	234	5	-
371	75	74	215	220	320	325	9	9	230	-	-
372	74	75	220	216	320	322	9	2	230	4	-
373	74	73	223	226	318	314	9	None	230	-	1
374	74	74	216	223	318	324	6	8			
375	74	73	223	224	326	327	5	4			
376	73	73	218	218	330	336	9	None			
377	75	73	226	234	318	310	3	None			
378	73	74	225	222	323	323	4	3	230	5	5
379	74	72	228	228	313	317	9	9			
380	74	73	230	228	310	310	6	8	226	7	-
381	73	72	223	223	323	323	7	4			
382	73	74	220	225	330	326	9	4			
383	74	74	222	222	322	325	1	1			
384	75	73	218	220	320	323	1	0	221	-	5

Appendix 12

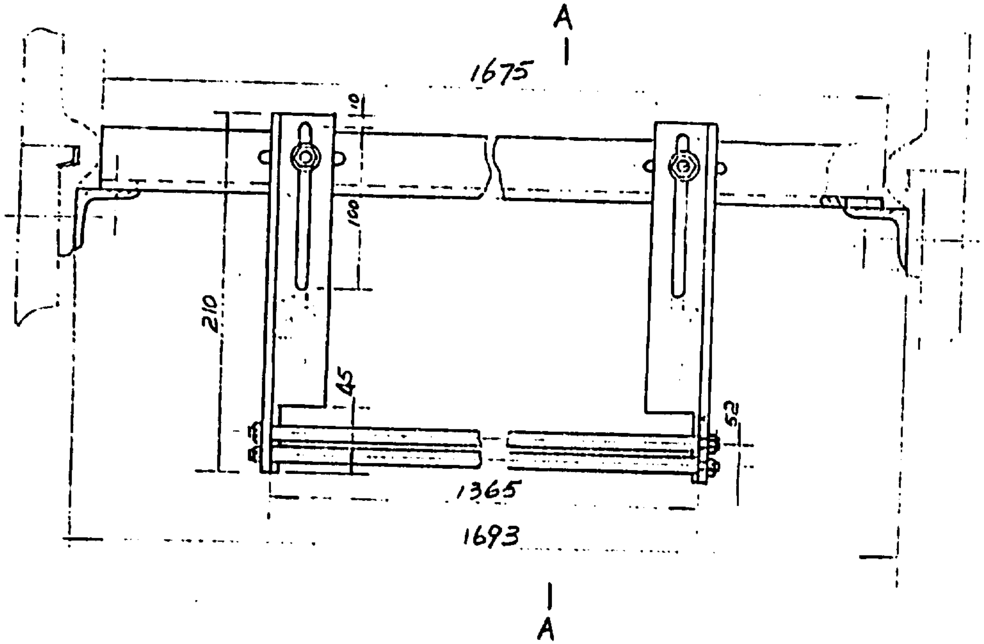
Weight Positions And End Tensions Recorded At ZhuZhou Mill, March 1994

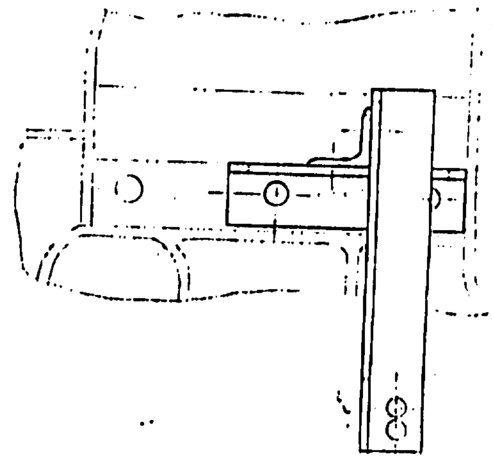
Loom Number	Weight position, 17/3 Left	Weight position, 17/3 Right	Weight position, 18/3 Left	Weight position, 18/3 Right	Flange depth visible	average damped	average peak
361	None	None	None	None	95	21	44.5
373	9	None	9	None	80	21	43.3
365	5	4	5	4	200	21	48.8
375	5	4	5	4	110	19.3	44.3
383	1	1	2	1	87	27.3	51.8
384	1	0	1	0	100	27.3	57.8

Appendix 13

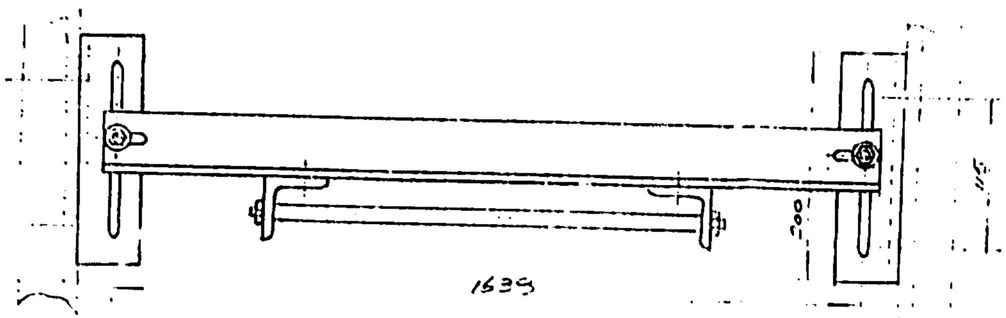
Drawings and Photographs of Prototype Restrictor Rods and Lease Rods
in use at the R.T.D.C., March 1994

Restrictor Rod Specifications (by Xian Qing Ye)





A—A



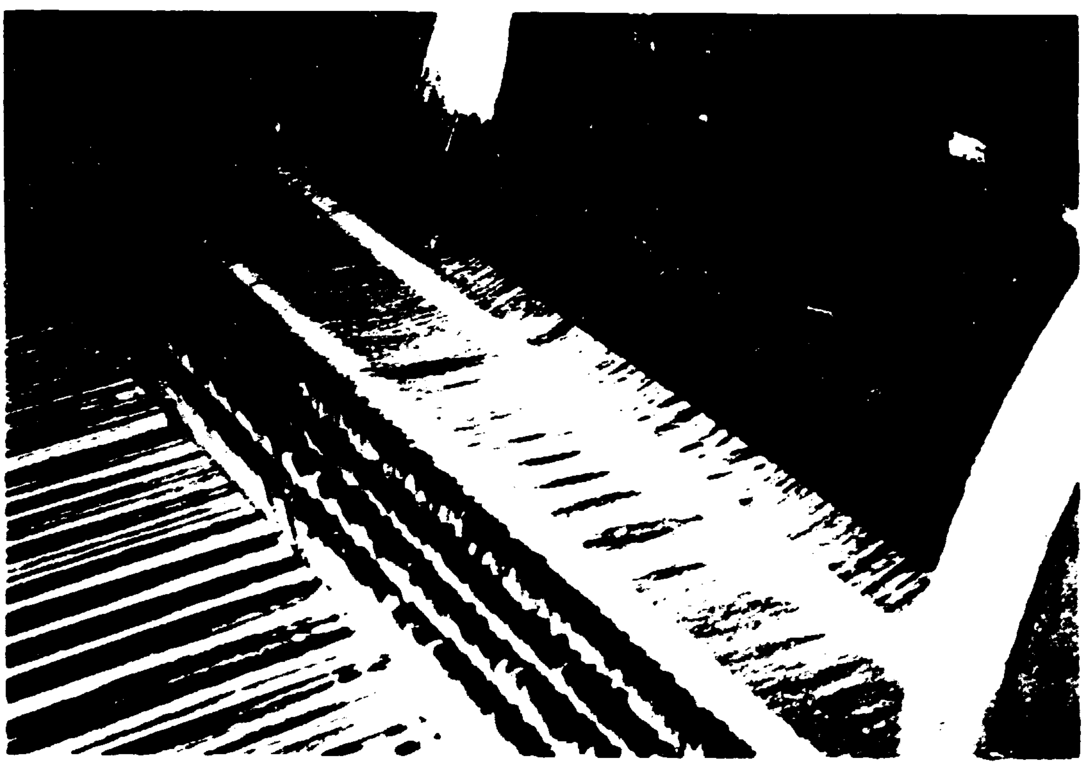
Restrictor Rod Motion

View Of Rear Shed Shortened by Restrictor Rods (front of loom to left in photo)

Detail Of Ends Passing Through Restrictor Rods (photo taken from rear of loom)

Detail Of Fixing And Adjustment Points Of Restrictor Rods

Lease Rods In Position



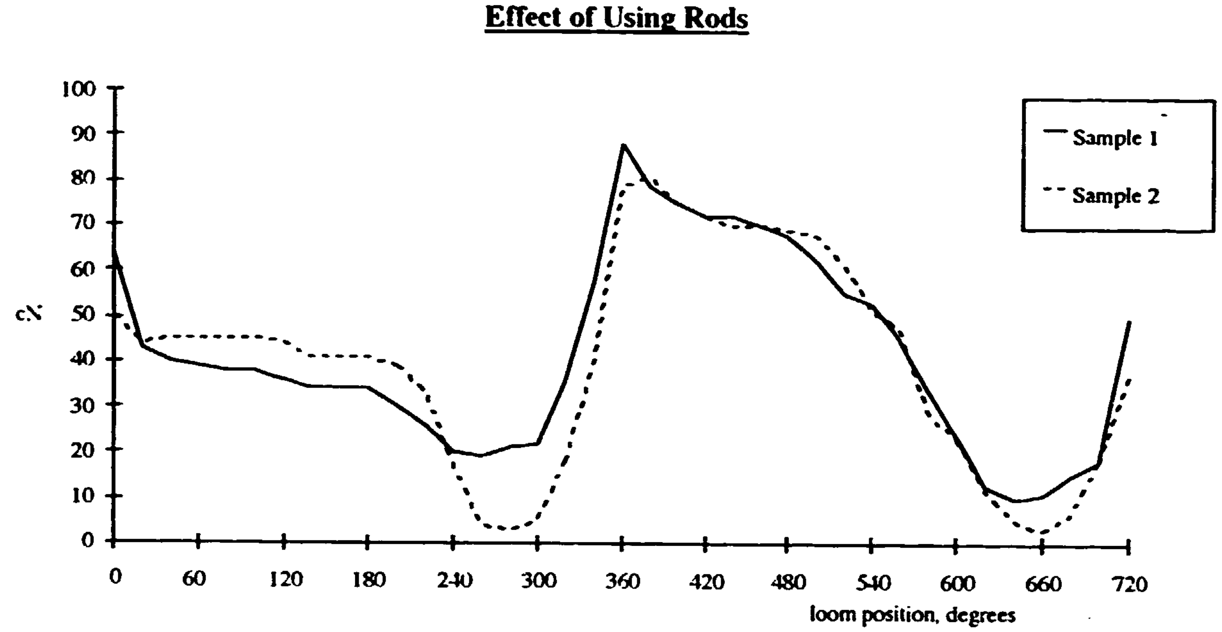
Appendix 14

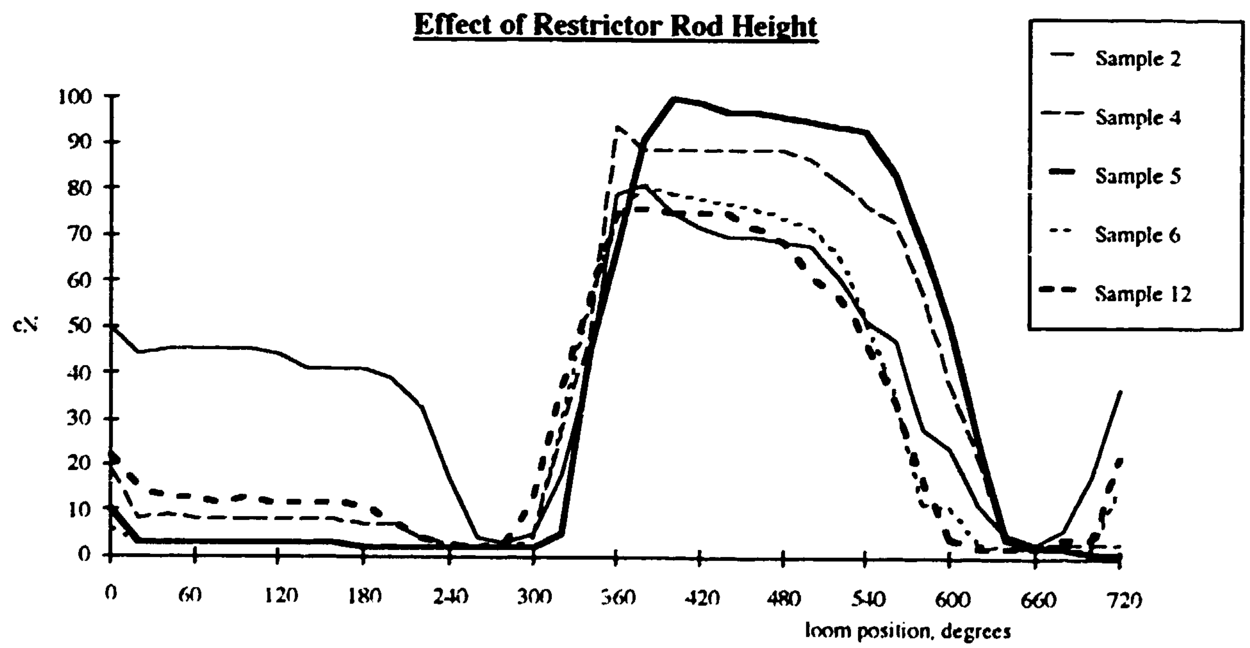
Experimental Variables Project 5

Sample Code	Backrest Setting, cm	Healds Level Timing, degrees	Back Rail Cam Timing, degrees	Weight Setting	Restrictor Rods Height, cm	Lease rod positions, cm
1	12	270	270	5		
2	12	270	270	7	15.4	
3	12	270	270	7	13.9	
4	12	270	270	6	13.9	
5	12	270	270	6	12.8	
6	12	270	270	6	13.4	
7	12	290	290	6	13.4	
8	10	270	270	6	13.4	
9	10	270	270	7	13.4	
10	7.5	270	270	7		6,16
11	7.5	270	270	7		6,8
12	10	270	270	6	14.4	

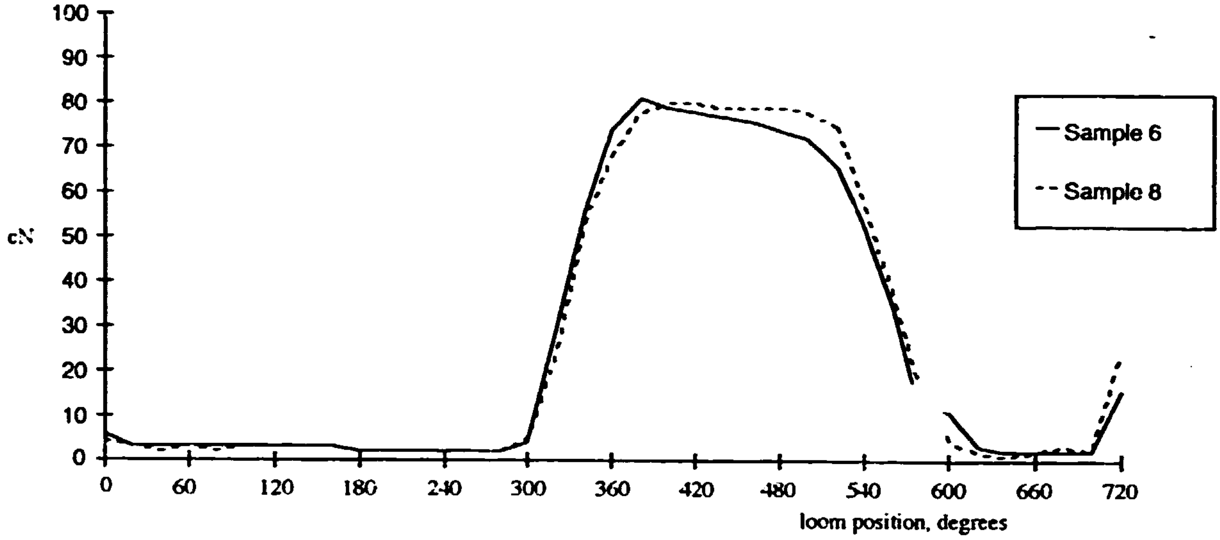
Appendix 15

The Effects of Loom Settings on Static Warp Tension, Project 5

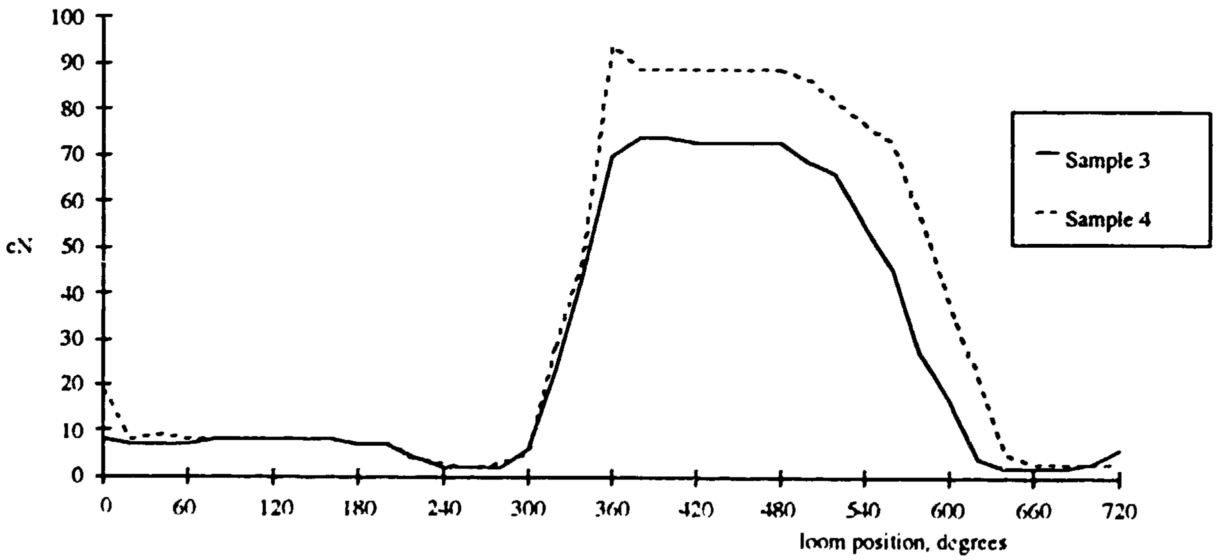




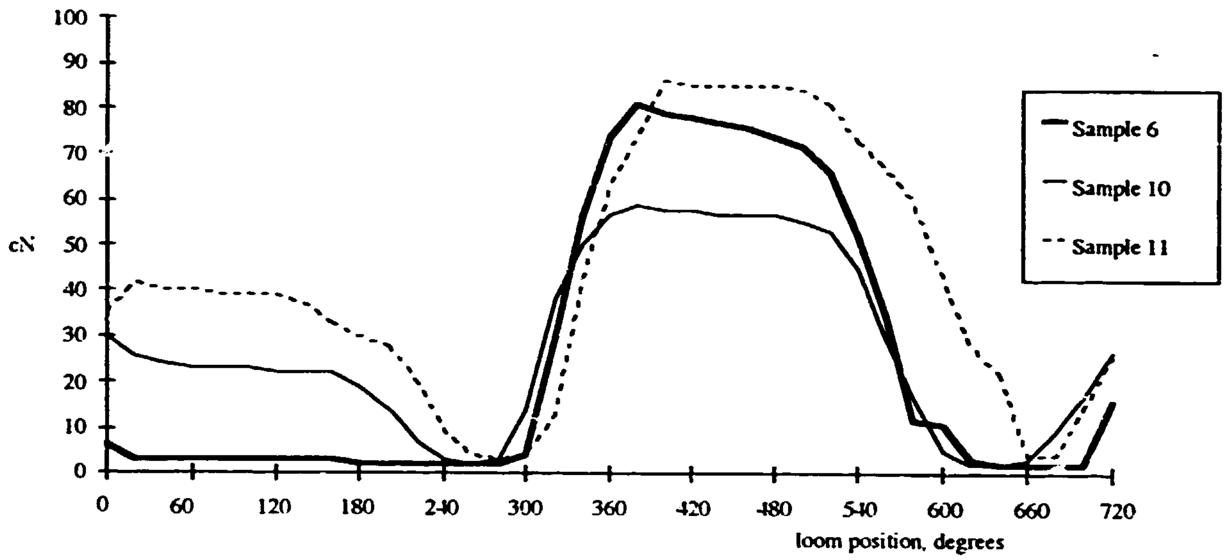
Effect of Back Rail Height



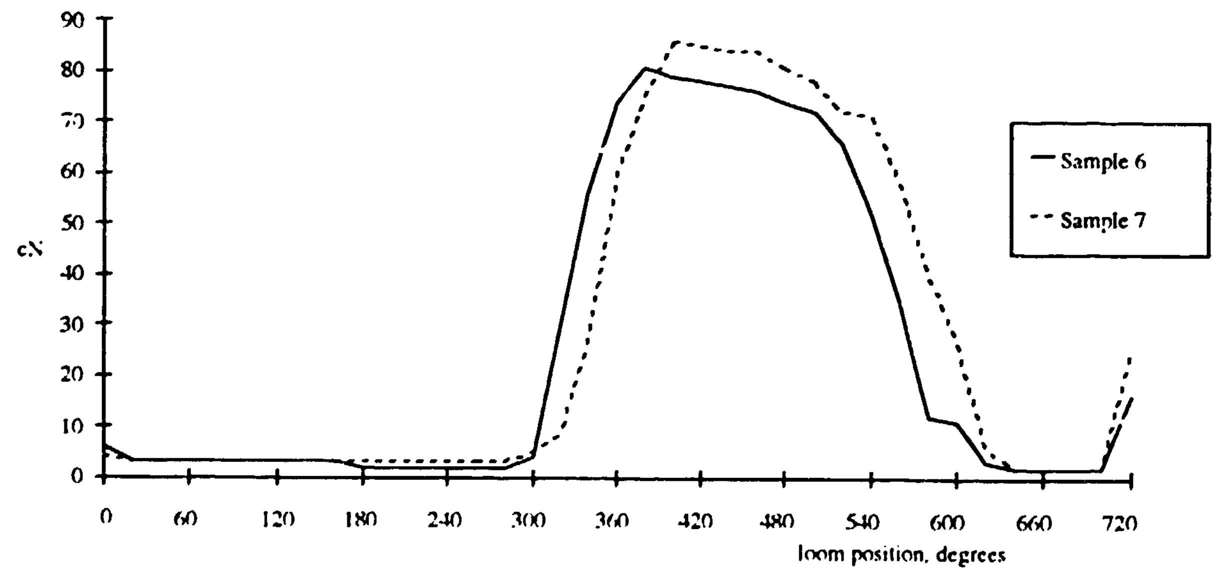
Effect of Tension Weight Position



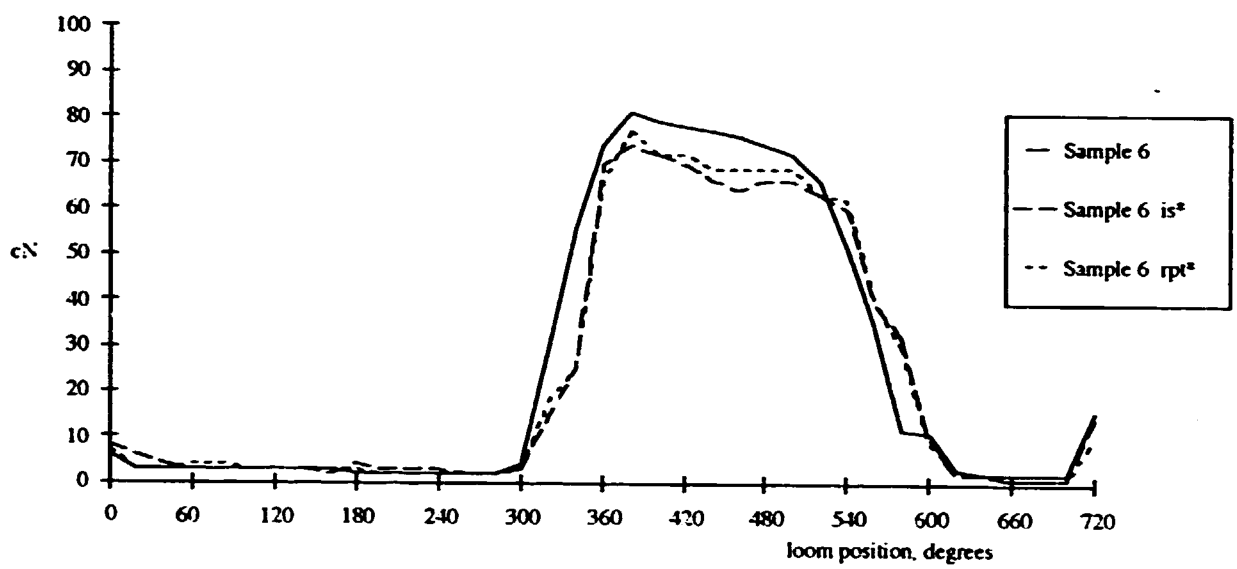
Effect of Using Lease Rods vs Restrictor Rods



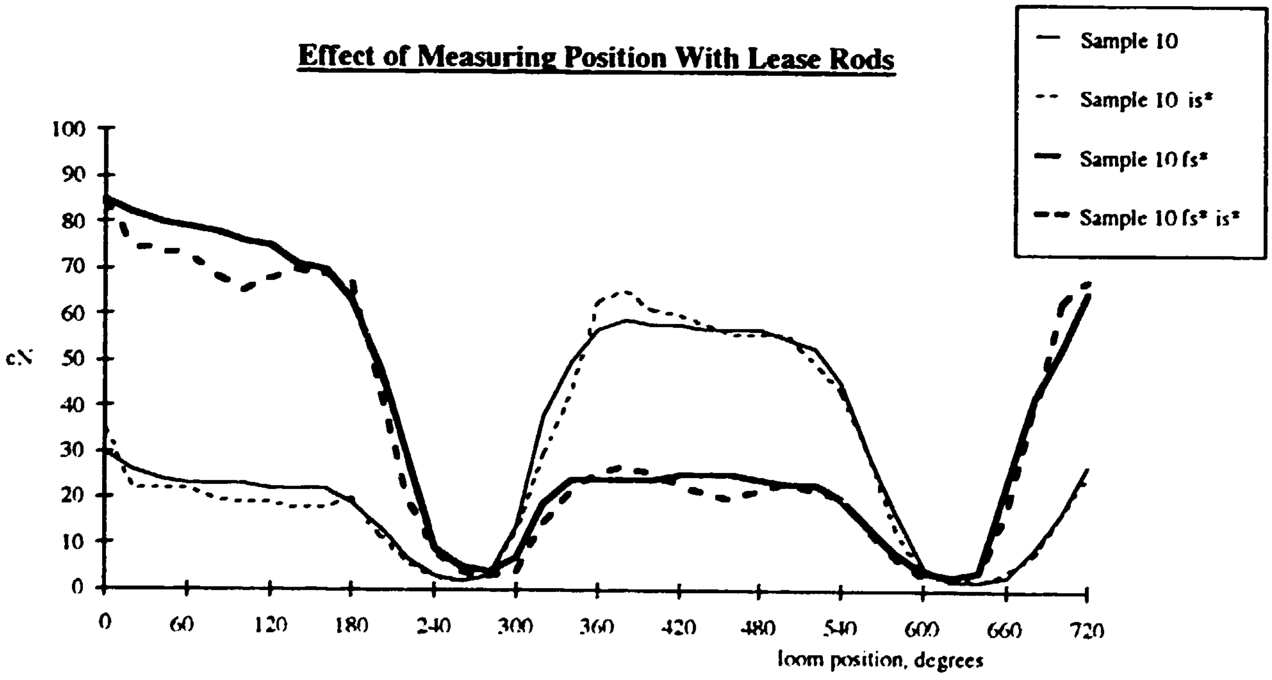
Effect of Healds Level Timing



Effect of Measuring Position With Restrictor Rods



Effect of Measuring Position With Lease Rods



* is = in shed, rpt = repeat; fs = front hreald shaft (all other readings were for ends drawn into the rear heald shaft)

Appendix 16

Table of Results Project 5

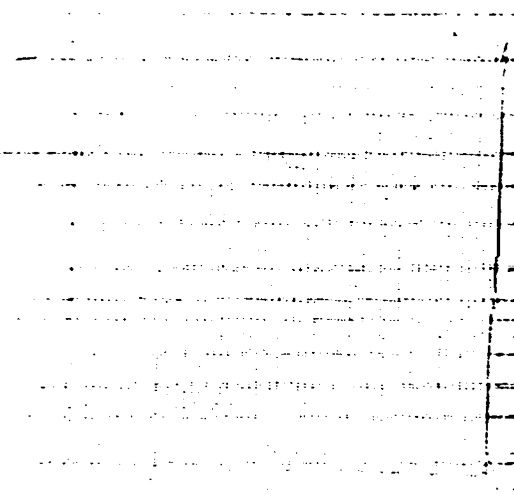
Sample Code	Backrest Setting	Healds Level	Back Rail Cam	Weight Setting	Restrictor Rods Height	Lease rod positions	Percentage Humidity	Warp Breaks			Cracks		Weaving Over	Reediness	
								Break	Yarn	Crossed	Minor	Major		Grey	Bleached
1	12	270	270	5			60	6	2	1	1		6		
2	12	270	270	7	15.4		60	8	8	3	1		9	10 (9.5)	7= (16.5)
3	12	270	270	7	13.9		60	3	1	4	1		8		
4	12	270	270	6	13.9		60						6	2= (31.5)	3 (30.5)
5	12	270	270	6	12.8		75	2						6 (20)	4 (26)
6	12	270	270	6	13.4		75	3	1				3	4 (24)	2 (32.5)
7	12	290	290	6	13.4		75	4	2				3	2= (31.5)	5 (21)
8	10	270	270	6	13.4		77	2	2		1		2		
9	10	270	270	7	13.4		77	2	1					1 (35)	1 (34.5)
10	7.5	270	270	7		6,16	80	3	1	1			7		
11	7.5	270	270	7		6,8	80	3	1					8 (15)	9 (15.5)
O	7.5	270	270	4										3 (28)	6 (18.5)
S	8.5	270	270	4										9 (12)	10 (13.5)
L	12	270	270	5										11 (7)	11 (5.5)
M	12	330	330	5										12 (3)	12 (4.5)
ZhuZhou1														7 (17.5)	7= (16.5)
12	10	270	270	6	14.4		57							Between 11 & ZZ 1	

Appendix 17

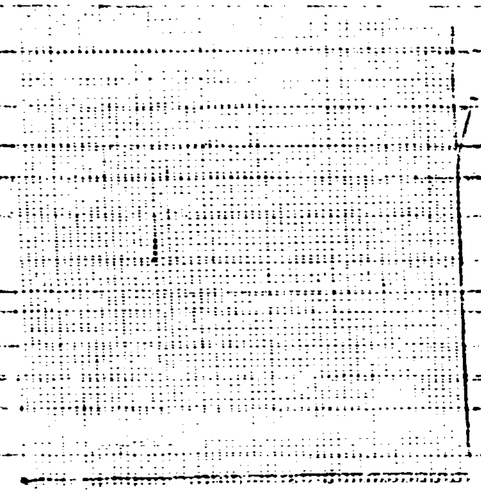
Examples of Reediness

Loomstate Samples

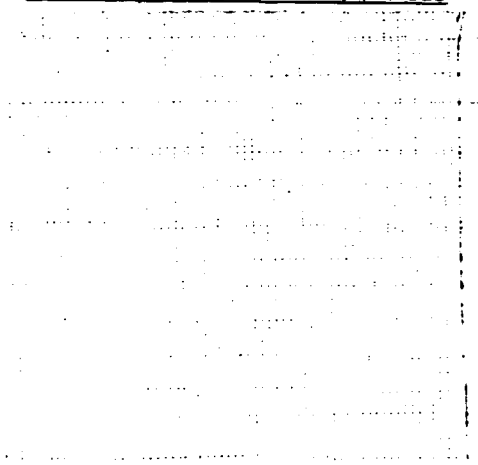
Best Sample With Restrictor Rods



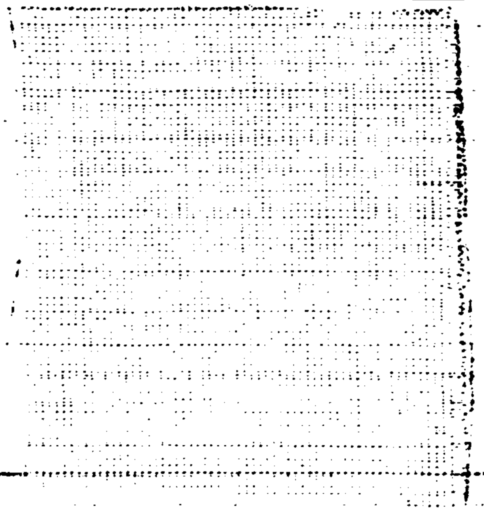
Best Sample With Lease Rods



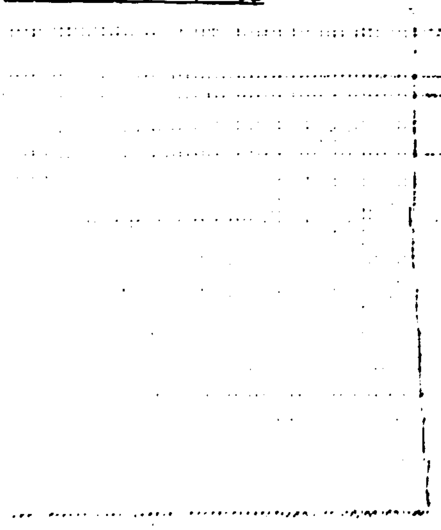
Best Sample Without Restrictor Rods



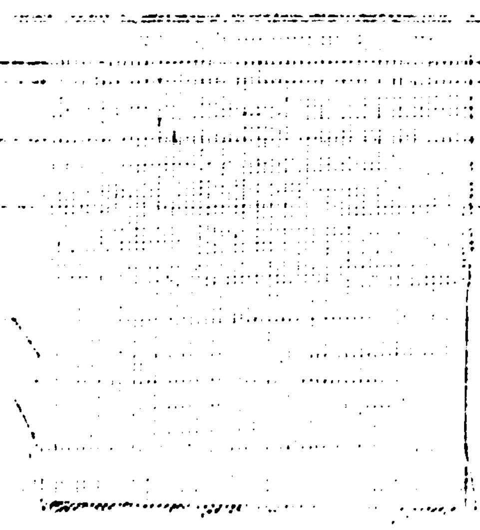
Worst Sample Without Restrictor Rods



Best Sample ZhuZhou

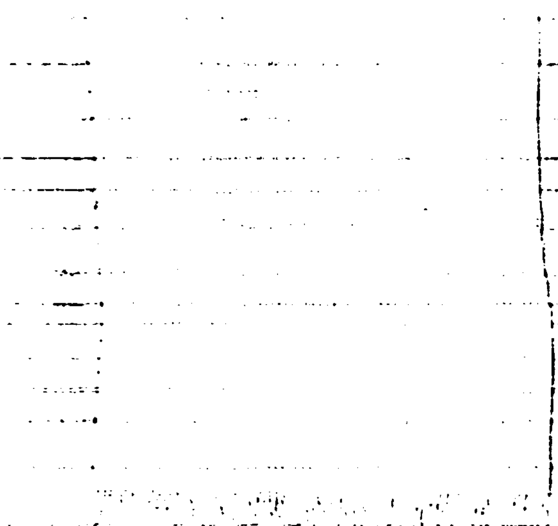


Worst Sample ZhuZhou

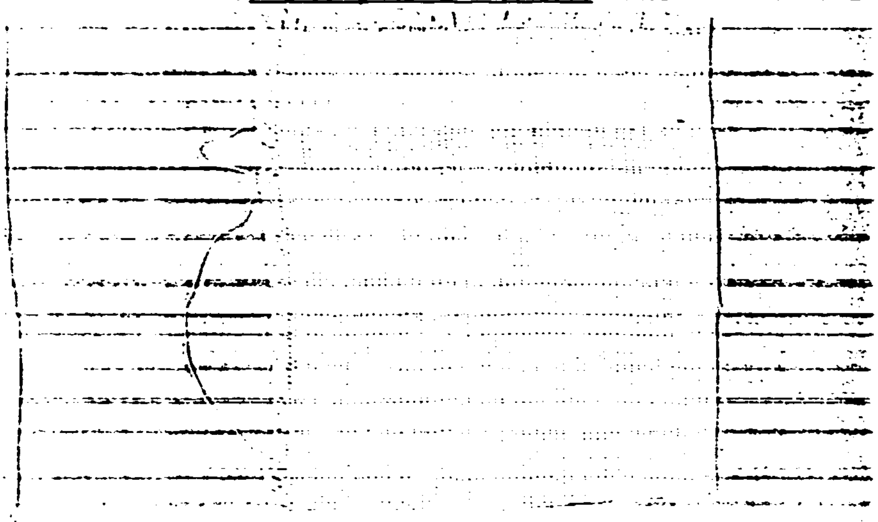


Bleached Samples

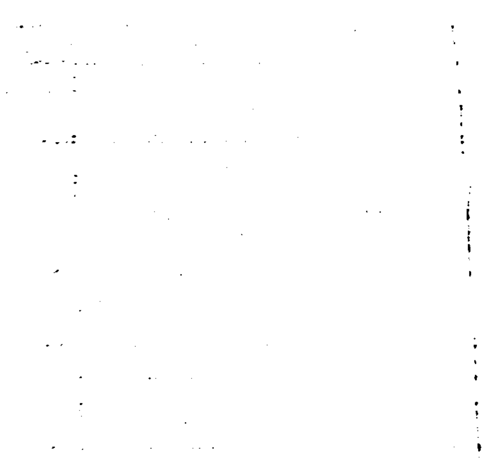
Best Sample With Restrictor Rods



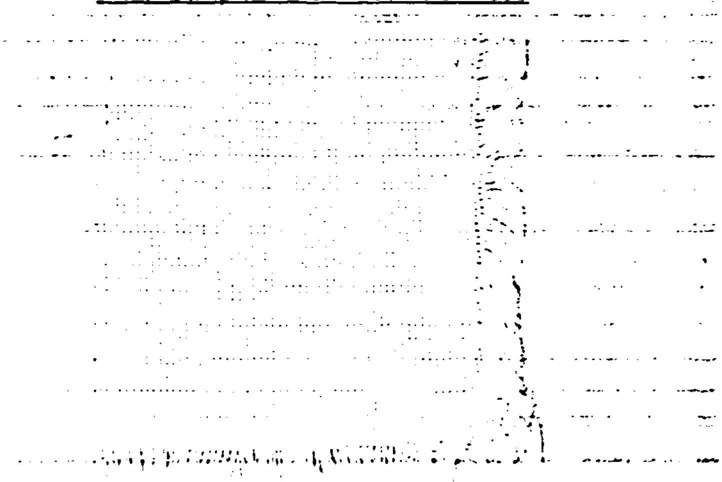
Best Sample With Lease Rods



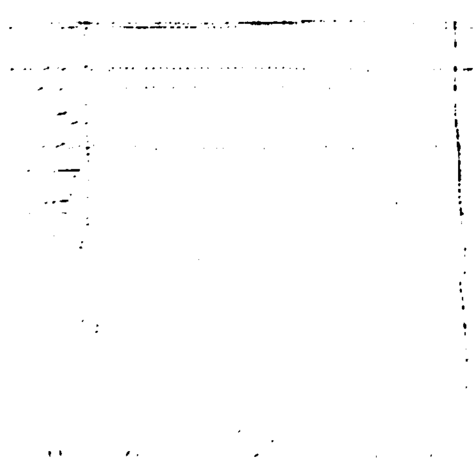
Best Sample Without Restrictor Rods



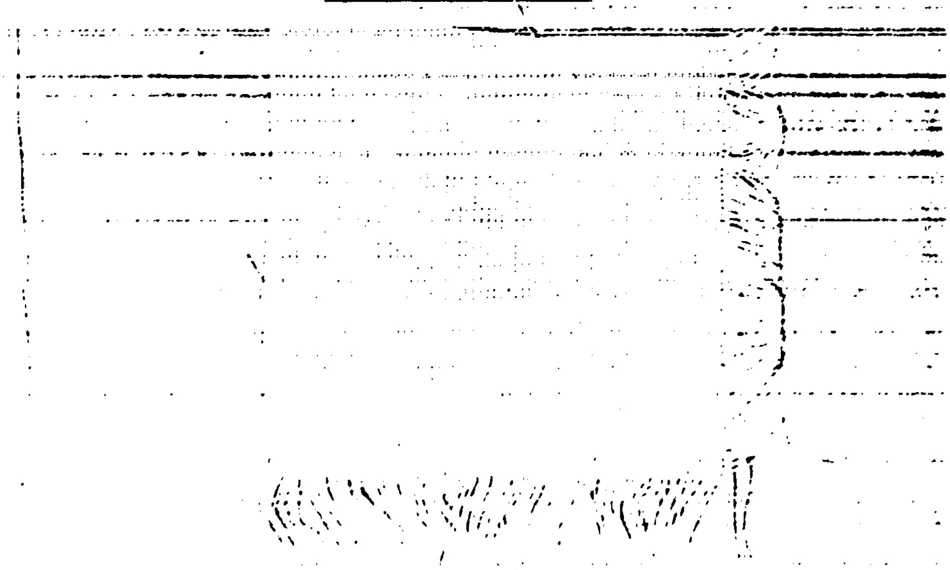
Worst Sample Without Restrictor Rods



Best Sample ZhuZhou



Worst Sample ZhuZhou



Appendix 18

Results of Preliminary Mill Trial

Before the restrictor rods were fitted :

No of Loom	Warp Breaks	Warp Breaking Causes						
		slub	Large knot	Fly	crossing warp	Slipping knot	~~Just Breaking~~ (Not known)	Temperature 26t Moisture 86% 2 hours
349	5	1			2		2	
350	4	2		1	1			
351	4	1	1	1				
352	5	1		2	2			

After the restrictor rods were fitted :

No of Loom	Warp Breaks	Warp Breaking Causes						
		slub	Large knot	Fly	Crossing warp	Slipping knot	~~Just Breaking~~ (Not known)	Temperature : 25～28°C Moisture : 84～87% Time : 2 hours/day x 6 days = 12 hrs.
349 *	21	3	2	1	5		10	
350	30	4	1	7	7		11	
351	25	4	2	4	6		9	
325	26	3	1	5	5	1	11	

* 1. Only No.349 was equipped with the restrictor rods.

2. The ~~shedding~~ fly on the No.349 was much less than other looms.
This is also shown in the reduced breakage due to fly.

3. The weavers complained that it wasn't very convenient to operate when the restrictor rods were fitted on the loom.

Allied Colloids

CONFIDENTIAL
TECHNICAL REPORT

Report No	93/640 (AJM/67)
Date	29/10/93
Author	PH/333/29/JAS
Department	Textile Division Sizing Section
For the sole consideration of	Hunan Ramie/Bolton Institute
Title	Evaluation of standard recipe against various A.C. recipes based on Vicol and Starch blends

Summary

The supplied yarn was sized with the standard and various A.C. recipes, and size on yarn and abrasion resistance was determined.

A recipe based on a 5:4:1 blend of corn starch : Vicol T : Vicol A : was found to give less hairiness and better yarn appearance than standard recipe.

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Appendix 19 Cont.

2 INTRODUCTION

The following work was carried out to determine a recipe based on Vicol and corn starch blends, which would give a better performance than the current recipe.

3 EXPERIMENTAL

3.1 Sizing of Supplied Yarn

The supplied Hunan Ramie yarn was sized using the following recipes:-

1	5%	PVA 17-88	
	1%	Carbocel MM15	
	3%	Unmodified Corn Starch	
	0.5%	Alcowax SB	
2	3%	Vicol T	
3	5%	Unmodified Corn Starch	
	5%	Vicol R	
4	3%	Unmodified Corn Starch	) 10 and 12%
	7%	Vicol R	) Conc^n
5	5%	Unmodified Corn Starch	
	5%	Vicol T	
6	5%	Unmodified Corn Starch	
	4%	Vicol T	
	1%	Vicol A	

Sizing was carried out using the Roaches laboratory sizing machine with a size bath temperature of 85°C.

3.2 Size on Yarn Determination

Duplicate samples of the sized yarns were scoured using:-

1.5 gl^{-1} Nervanase 10X
1.0 gl^{-1} Alcopol 650

at 70°C for 30 minutes, the temperature was then raised to 90°C for a further 20 minutes.

The yarns were then rinsed well in warm water and dried in an oven at 110°C for 1 hour.

The percentage scour loss and size on yarn was then calculated.

The results are given in Section 4.1.

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Appendix 19 Cont.

3.3 Abrasion Resistance

The sized yarns were conditioned at 75% RH, 20°C for 48 hours prior to being abraded using the A.C. Eurotech Abrader under the following conditions:-

3000	Cycles
540°	Yarn/yarn contact
20	gm/thread

The number of broken threads were noted.

4. RESULTS

4.1 Size on Yarn and Abrasion Resistance

Recipe	% Scour Loss	% S.O.Y.	No of Cycles Broken Threads
5% PVA 17-88 1% Carbocel MH15 3% Corn Starch 0.5% Alcowax SB 9%	5.6	4.2	3000 0
3% Vicol T	3.1	1.7	3000/25
5% Corn Starch 5% Vicol R	4.8	3.4	3000/15
(10+12% Nom^{n} Con^{n}) 3% Corn Starch 7% Vicol R	 5.1 6.8	 3.7 5.6	 3000/21 3000/7
5% Corn Starch 5% Vicol T 5%	5.0	3.6	3000/2
5% Corn Starch 4% Vicol T 1% Vicol A 9%	5.4	4.1	3000/0
Unsized	1.4	-	-

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Appendix 19 Cont.

5. CONCLUSION

The recipe based on a 5:4:1 blend of corn starch: Vicol T:Vicol A gave similar abrasion resistance to the standard recipe but the yarn was less hairy. It would be therefore expected to give at least as good a weaving performance as the current recipe.

..............P Hargreaves

..............A Maliszewski
Laboratory Manager
Sizing Section

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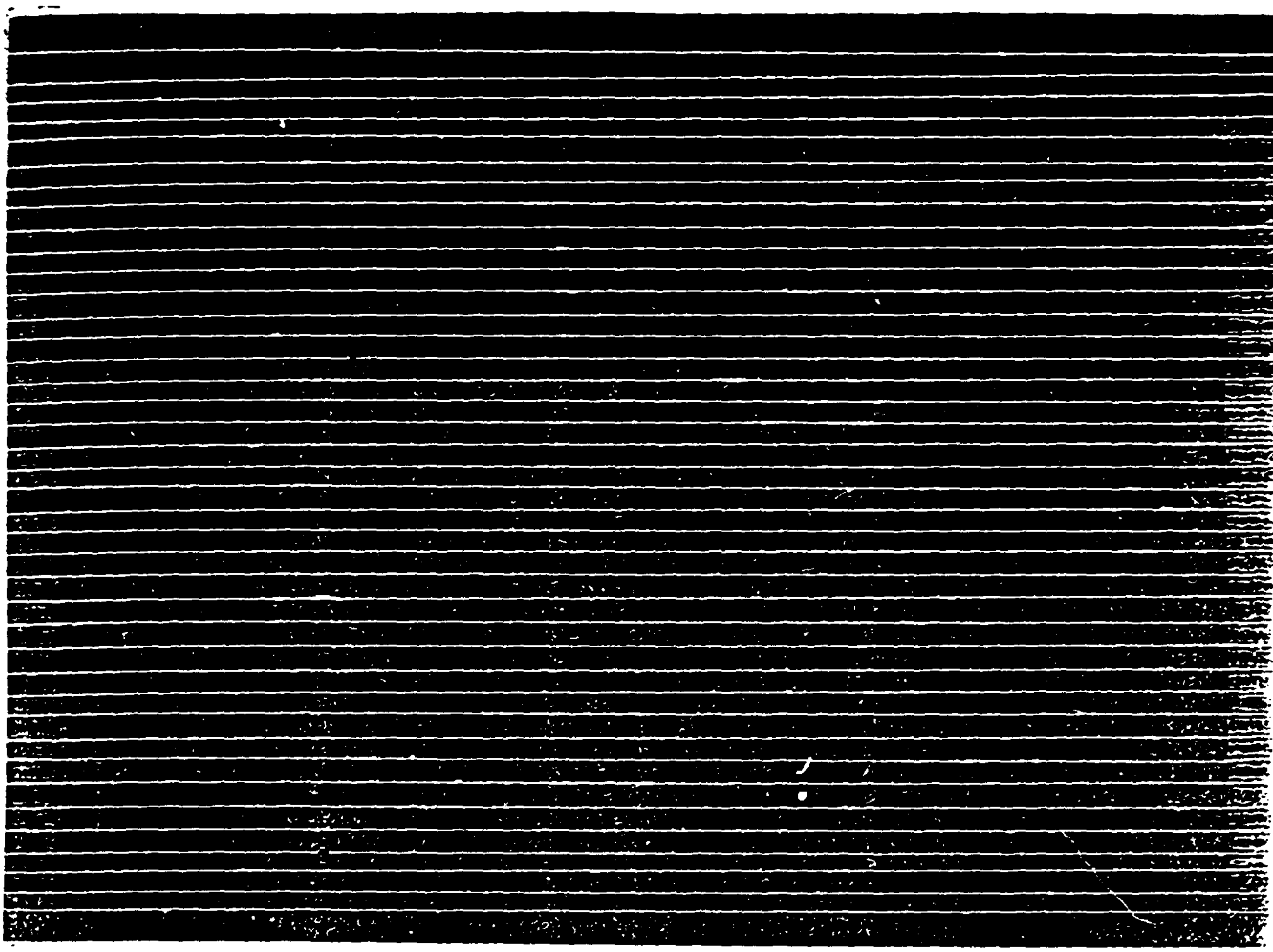
SUPPLIED HUNAN RAMIE WOOL SIZED WITH STANDARD RECIPE:

5%	PVA 17-88
1%	CARBOCEL MM15
3%	UNMODIFIED CORN STARCH
0.5%	ALCOWAX SB

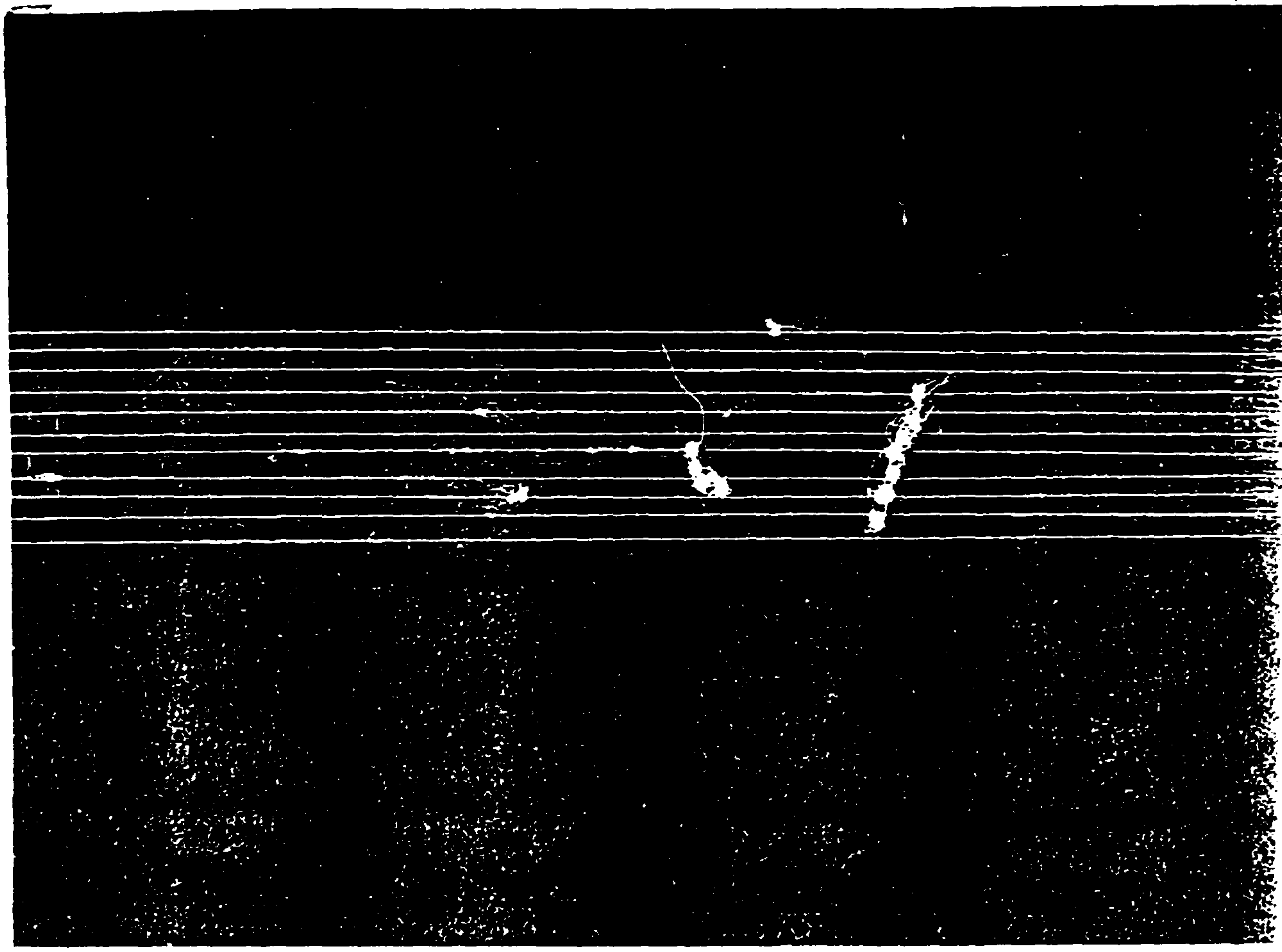


4.18% S.O.Y.

Abraded on the A.C. Eurotech Abrader under the following conditions:

3000	Cycles
0	Broken Threads
540°	Yarn/Yarn Contact
20	gm/Thread Tension
75%	RH
20°C	Temperature

SUPPLIED HUNAN RAMIE WOOL SIZED WITH VICOL T



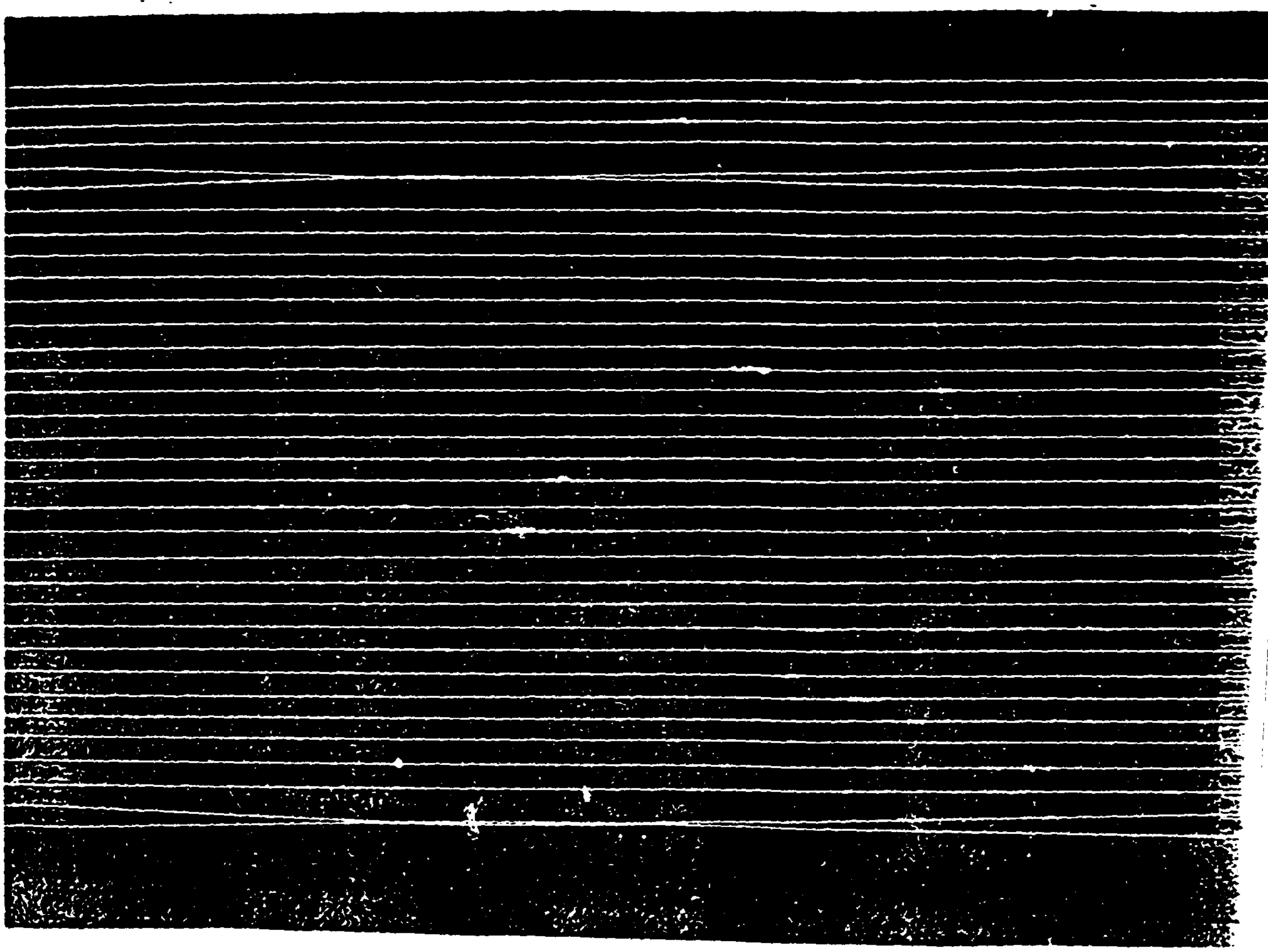
1.71% S.O.Y.

Abraded on the A.C. Eurotech Abrader under the following conditions:

3000	Cycles
25	Broken Threads
540°	Yarn/Yarn Contact
20	gm/Thread Tension
75%	RH
20°C	Temperature

SUPPLIED HUNAN RAMIE WOOL SIZED WITH: 5% UNMODIFIED CORN STARCH

5% VICOL R



3.43% S.O.Y.

Abraded on the A.C. Eurotech Abrader under the following conditions:

3000 Cycles

15 Broken Threads

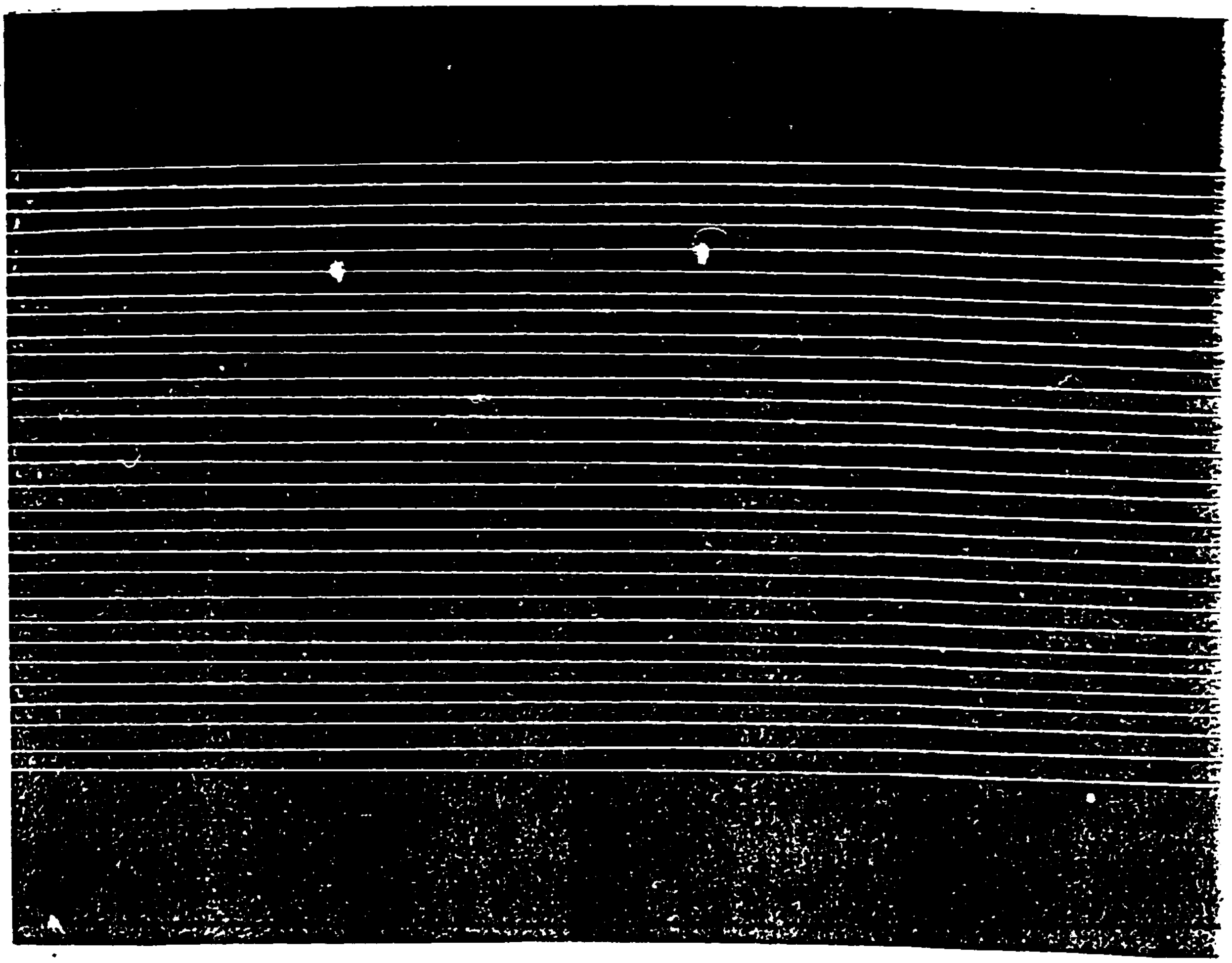
540° Yarn/Yarn Contact

20 gm/Thread Tension

75% RH

20°C Temperature

SUPPLIED HUNAN RAMIE WOOL SIZED WITH: 7% VICOL R
3% UNMODIFIED CORN STARCH



3.71% S.O.Y.

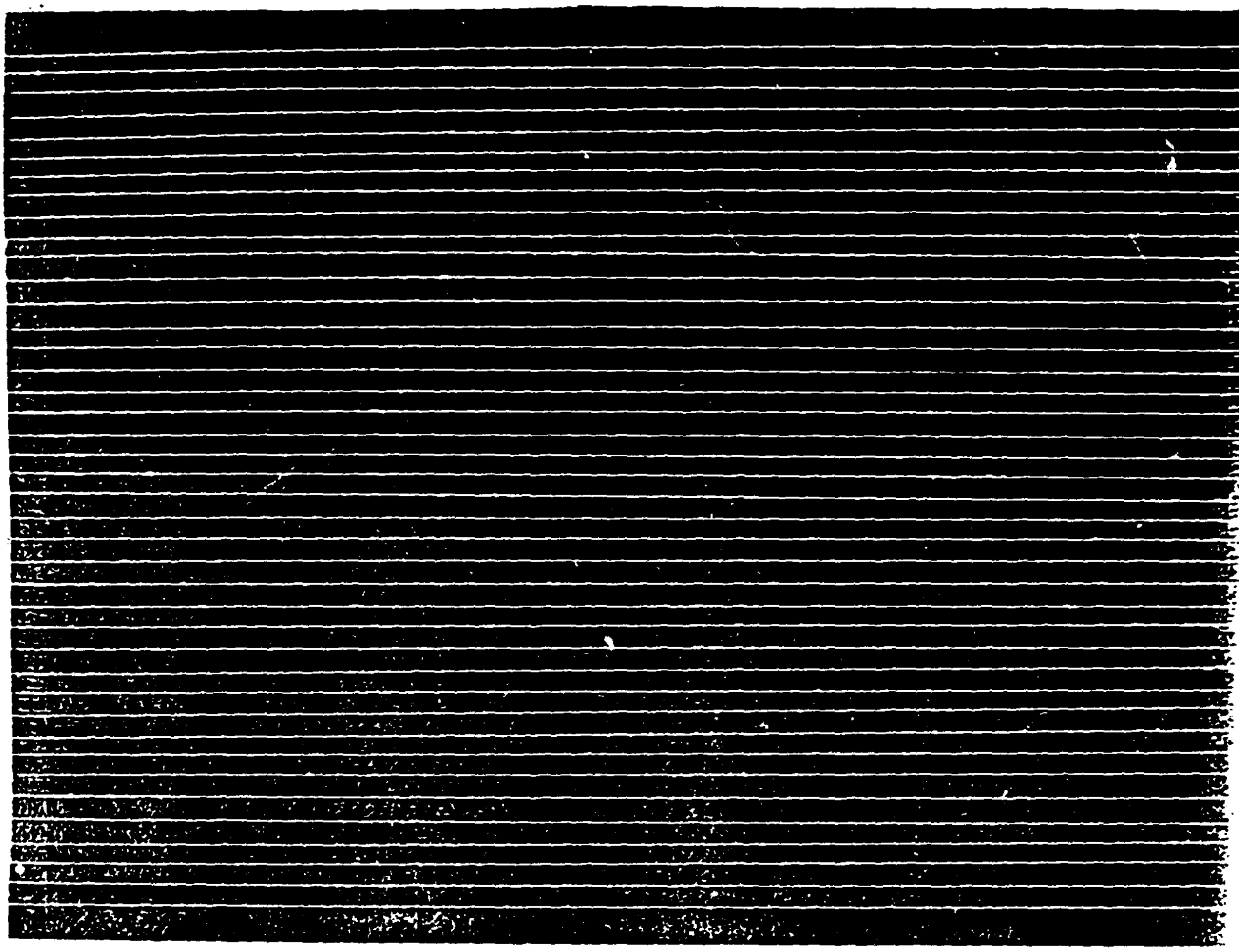
Abraded on the A.C. Eurotech Abrader under the following conditions:

3000	Cycles
21	Broken Threads
540°	Yarn/Yarn Contact
20	gm/Thread Tension
75%	RH
20°C	Temperature

Appendix 19 Cont.

SUPPLIED HUNAN RAMIE WOOL SIZED WITH: 7% VICOL R

3% UNMODIFIED CORN STARCH



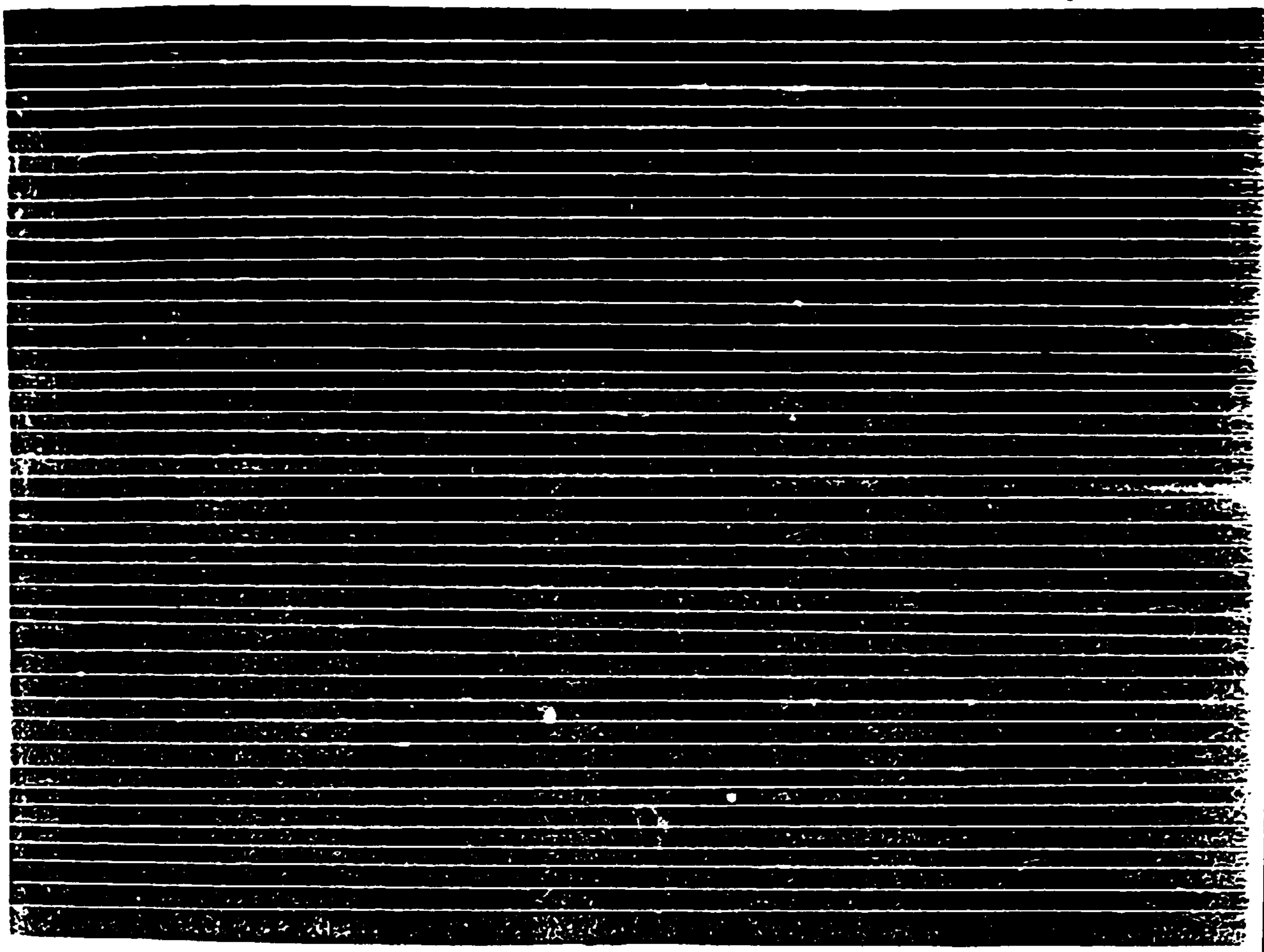
5.45% S.O.Y.

Abraded on the A.C. Eurotech Abrader under the following conditions:

3000	Cycles
7	Broken Threads
540°	Yarn/Yarn Contact
20	gm/Thread Tension
75%	RH
20°C	Temperature

SUPPLIED HUNAN RAMIE WOOL SIZED WITH: 5% VICOL T

5% UNMODIFIED CORN STARCH

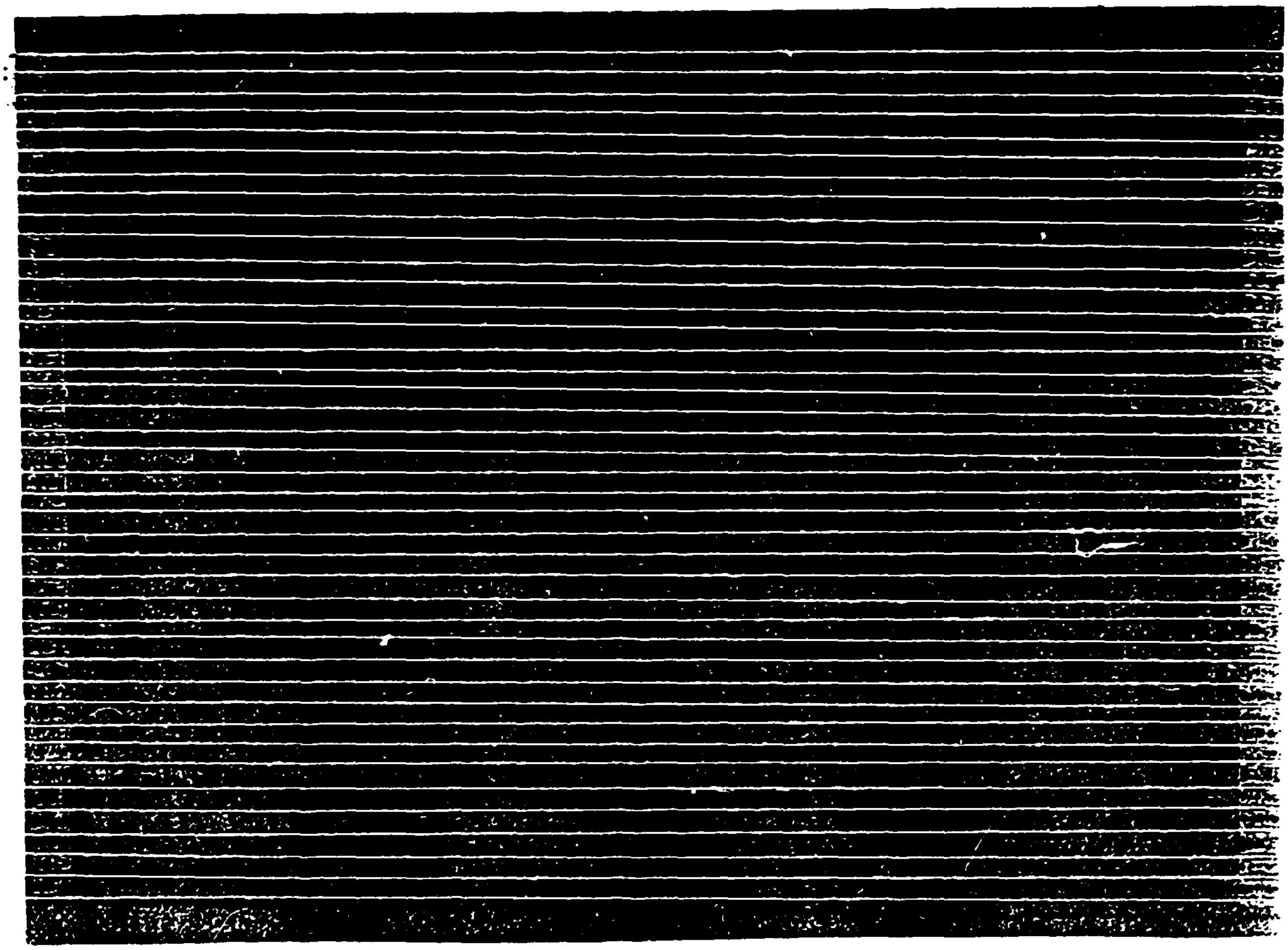


3.59% S.O.Y.

Abraded on the A.C. Eurotech Abrader under the following conditions:

3000	Cycles
2	Broken Threads
540°	Yarn/Yarn
20	gm/Thread Tension
75%	RH
20°C	Temperature

SUPPLIED HUNAN RAMIE WOOL SIZED WITH: 5% UNMODIFIED CORN STARCH
4% VICOL T
1% VICOL A



4.05% S.O.Y.

Abraded on the A.C. Eurotech Abrader under the following conditions:

3000	Cycles
0	Broken Threads
540°	Yarn/Yarn Contact
20	gm/Thread Tension
75%	RH
20°C	Temperature

Appendix 20

A Report by Xian Qing Ye

Evaluation of two Sizing Recipes for Ramie Yarn

1. Introduction

Excessive hairiness, low regularity and low elongation at break are three troublesome properties of ramie yarn. The weavability of ramie yarn is restricted greatly by these properties. The following work was carried out with the aim of finding a better sizing recipe in order to improve the weavability of ramie yarns.

2. Materials

The yarn used in this experiment was the pure ramie yarn of 36 Nm from Hunan China.

Sizing materials were provided by Allied Colloids. The following recipes were adopted :

Recipe A	4% PVA 17-88 (poly-vinyl alcohol)
	0.8% carbocel MM15 (sodium carboxy methyl cellulose)
	4% Unmodified Corn Starch
	0.4% Alcowax SB (a synthetic wax)
Recipe B	4% Unmodified Corn Starch
	3.2% Vicol T (a poly acylonitrile adhesive)
	0.8% Vicol A (a poly acylonitrile adhesive)

3. Sizing

Sizing was carried out using the laboratory sizing machine at Huddersfield University. The sizing parameters were :

Size bath temperature:	70°C
Nip pressure:	7 kg per linear inch
Running speed:	40 m min^{-1}
Dryer temperature:	150°C

4. Weaving

The two kinds of yarn separately sized with Recipe A and Recipe B (henceforth referred to as Sample A and Sample B) were woven on a Nothern automatic pirn changing loom with cam shedding.

For each sample, 400 ends of the cotton yarn contained on the loom beam were replaced by the sized ramie yarn and the woven.

During weaving the frequency and causes of warp breaks were noted and the amount of clinging in the rear shed was subjectively assessed.

Warp breaks were of three types : Those due to crossed ends; those due to slipping knots and those due to yarn rupture.

Shed formation for both samples was good with few clinging ends. The warp breaks were as follows :

Sample A (3850 picks) :	6 ends, including : crossing warp 2 ends, knot slipping 2 ends
Sample B (2490 picks) :	5 ends, including : crossing warp 2 ends, knot slipping 1 end

5. Testing

30 tensile tests each were carried out on Sample A and Sample B, sized and woven, and the unsized yarn using an Instron Tensile Testing Machine. The results were as follows (BL - Breaking load, E - Elongation) :

NO	UNSIZED YARN		SAMPLE A				SAMPLE B			
			SIZED		WOVEN		SIZED		WOVEN	
	BL (N)	E (%)	BL (N)	E (%)	BL (N)	E (%)	BL (N)	E (%)	BL (N)	E (%)
1	5.10	3.5	4.7	1.9	5.3	1.7	8.4	2.2	4.8	1.8
2	3.5	2.7	7.1	2.3	6.6	2.0	5.3	1.8	6.3	2.1
3	5.5	3.5	6.7	2.0	5.4	1.8	8.8	2.3	8.9	2.3
4	6.0	3.7	4.0	1.6	6.2	2.0	6.9	1.9	5.4	1.9
5	4.5	3.2	5.9	2.0	5.8	1.8	6.1	1.9	5.9	1.8
6	4.7	3.3	6.0	2.0	7.7	2.3	3.7	1.5	4.0	1.5
7	4.8	3.3	4.5	1.5	6.1	1.8	4.5	1.5	5.5	1.9
8	3.9	2.7	5.3	2.1	5.0	1.6	6.4	1.9	4.9	1.7
9	6.2	3.6	5.4	1.6	3.0	1.3	7.6	2.0	3.8	1.5
10	5.8	3.5	7.1	2.1	5.3	1.8	6.8	2.1	3.6	1.2
11	3.9	2.6	5.1	2.0	6.0	2.0	5.0	1.7	7.8	2.2
12	4.3	3.4	5.5	2.0	4.4	1.3	5.6	1.8	4.0	1.5
13	4.8	3.3	8.1	2.2	5.3	1.6	6.6	1.8	6.2	2.1
14	4.4	2.8	6.7	2.0	7.6	2.1	6.8	1.9	6.3	2.0
15	4.5	3.3	3.2	1.2	5.0	1.8	4.3	1.3	3.5	1.5
16	4.7	3.3	6.7	2.2	2.9	1.1	6.1	1.9	4.9	1.7

Table 1 Breaking Loads in Newtons

NO	UNSIZED YARN		SAMPLE A				SAMPLE B			
			SIZED		WOVEN		SIZED		WOVEN	
	BL (N)	E (%)	BL (N)	E (%)	BL (N)	E (%)	BL (N)	E (%)	BL (N)	E (%)
17	4.7	2.8	8.4	2.4	5.8	2.0	6.1	2.0	5.8	2.0
18	5.6	3.4	5.5	1.9	3.8	1.3	5.3	1.7	5.8	2.0
19	4.2	3.1	5.1	2.0	4.8	2.0	7.2	1.8	6.1	1.7
20	5.7	3.6	7.6	2.4	4.4	1.8	5.0	1.6	6.5	2.1
21	2.7	2.3	7.2	2.4	6.1	2.3	5.6	1.7	5.7	1.8
22	4.0	2.8	6.0	2.1	6.0	2.3	5.2	1.5	4.5	1.5
23	5.3	3.2	7.0	2.2	5.0	2.0	4.4	1.6	5.6	2.0
24	7.1	3.6	5.5	1.8	6.6	2.4	6.5	1.8	7.8	2.1
25	5.2	3.2	4.8	1.7	5.1	1.9	5.1	1.9	8.5	2.4
26	3.3	2.7	4.5	1.7	4.2	1.6	5.5	1.7	6.6	2.0
27	4.6	2.9	4.9	1.6	6.3	2.0	5.1	1.6	7.8	2.1
28	5.3	3.4	4.8	1.5	6.4	2.1	4.6	1.6	5.9	2.0
29	5.0	3.5	5.3	1.8	1.6	0.8	7.0	2.1	7.5	2.0
30	4.8	3.4	8.0	2.2	4.6	1.6	5.8	1.7	5.6	1.6
AV.	4.8	3.2	5.9	1.9	5.28	1.8	5.9	1.8	5.9	1.9

<u>Table 2 Percentage Breaking Extensions</u>

6. Size on Yarn Determination

Duplicate samples of the sized yarns were scoured using :

$1.5 \, gl^{-1}$ Nervanase 10x
$1.0 \, gl^{-1}$ Alcopol 650

at 70^{o}C for 30 minutes, the temperature was then raised to 90^{o}C for a further 20 minutes.

The yarns were then rinsed well in warm water and dried in an oven at 110^{o}C for 1 hour.

The percentage scour loss and size on yarn was then calculated. The results are :

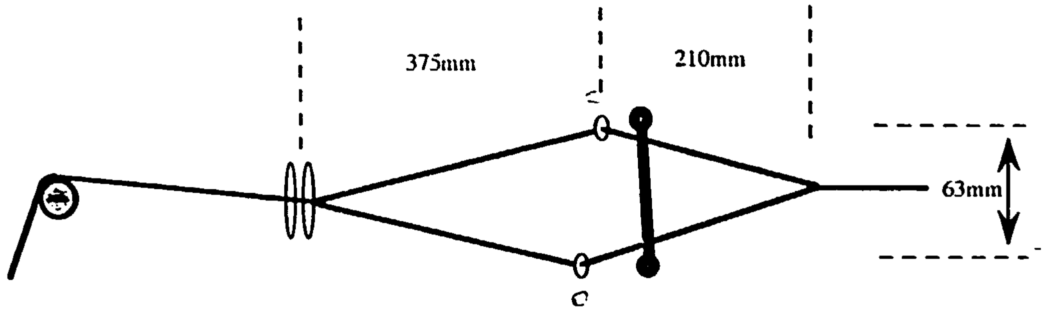
Sample A :	Scour Loss 15.0%
	S.O.Y. 9.6%
Sample B :	Scour Loss 15.9%
	S.O.Y. 10.5%
Unsized Yarn :	Scour Loss 5.4%

7. Yarn Wrappings

Yarn wrappings made of the unsized yarn, sized yarn and yarn removed from just before the fell after weaving are included as appendix 1.

Whilst some changes due to weaving can be observed - there are fewer individual hairs, but both samples show instances of entanglements - the results are good and similar for both samples.

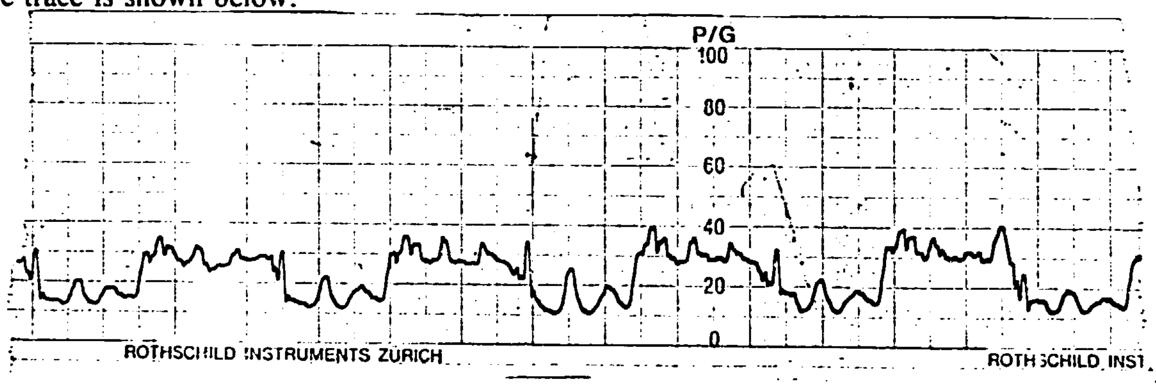
8. The geometry of the warp line is shown below



The shed size is substantially smaller than that on the 1515 loom.

9. Warp Tension

The running warp tension was measured using a Rothschild electronic tension meter. A portion of the trace is shown below:



The tensions were considerably lower than those recorded on the 1515 loom, mainly due to the small shed size.

10. Discussion

Before discussing the results it is necessary to compare the experimental conditions.

The conditions on the single end sizing machine are more favourable than those on an industrial machine because the space between ends is greater, and hence splitting is unnecessary. On the other hand, the percentage loss in elongation at break, 42%, was more than that reported by Mr D. Bland as being obtained at Zhuzhou Mill (30%). This suggests that the tension applied to each end on the Huddersfield machine was comparatively high.

The heald movement is 35% greater on the 1515 loom than the Northrop, and the rear shed angle is 25% greater (12°C and 9.6°C respectively). The warp tensions on the 1515 loom are approximately twice as high. The warp sett on the 1515 loom was 6.5% lower (22.8 ends cm^{-1} opposed to 24.4 ends cm^{-1}). All of these factors would lead one to expect a clearer shed on the 1515 loom. In fact the reverse was the case.

A final difference arose because the warp in the Northrop loom was partly cotton, partly ramie. Since the elongation at break of the ramie is less than half that of cotton, it would bear a disproportionately high share of the stresses of weaving.

Graphs 1 to 4 summarise the results tabulated in Section 5.

As shown in graph 1, the strength distribution of Sample B is superior to that of Sample A, although the average strength of Sample B is the same as that of Sample A.

After Sample A and B are woven, the average strength and strength distribution of Sample B are all superior to those of Sample B (shown in graph 2). Graphs 3 and 4 show that the average elongations at break of Sample B and Sample A are almost the same. For woven yarns, however, Sample A is clearly inferior to Sample B in the elongation distribution.

In all four samples it is the number of low results that are significant. These are the yarns which are likely to break. Five of the yarns from Sample A recorded elongation at break of less than 1.6% compared a single yarn from Sample B.

Similarly three yarns from Sample A recorded breaking loads of less than 4 Newtons compared with one yarn from Sample B.

A mathematical analysis of the number of warp breaks seems to indicate that Sample A is superior to Sample B. However, because the small number of warp breaks, this indication is not valid.

11. Conclusions

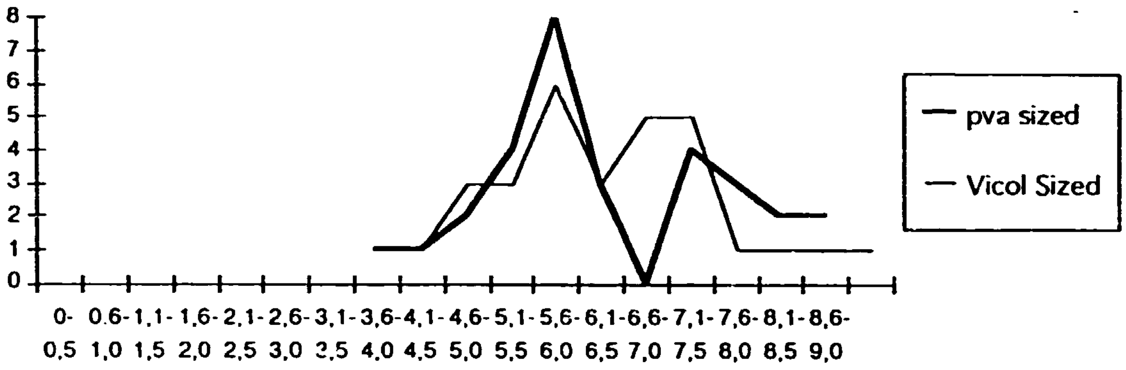
Two important conclusions can be drawn.

1. If one considers the unfavourable conditions described in Section 10 and the results

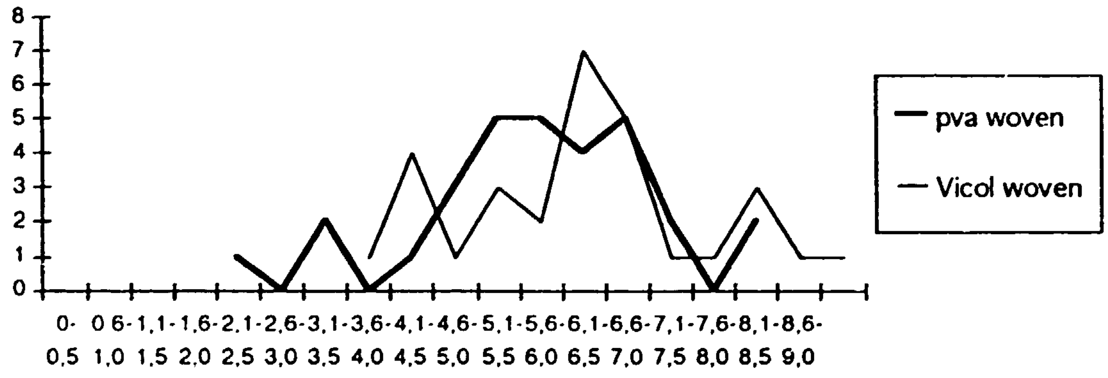
obtained, in particular with respect to clear shed formation, both samples performed far better than yarn sized at Zhuzhou Mill. This indicates that improvements to the quality of sized ingredients and/or process control during size preparation and sizing are possible.

2. The Vicol containing size is likely to perform better than the PVA and SCMC containing size, but industrial trials are necessary to establish this.

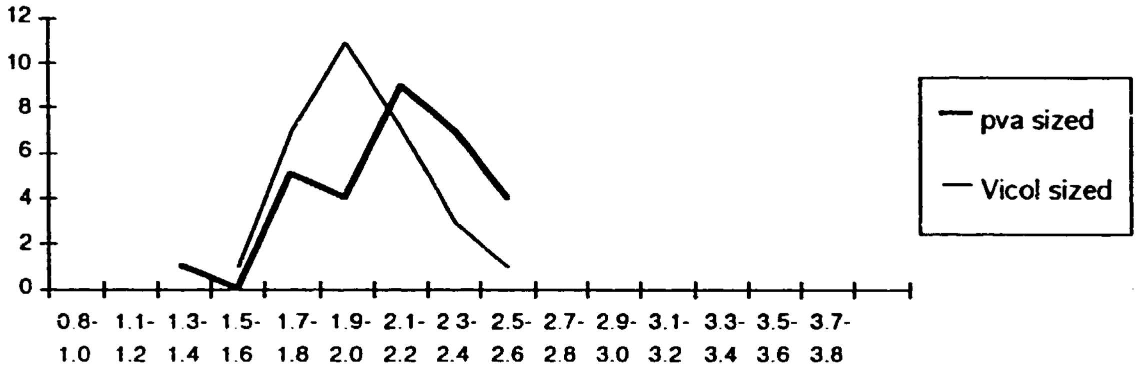
Graph 1 **Breaking Load in Newtons**



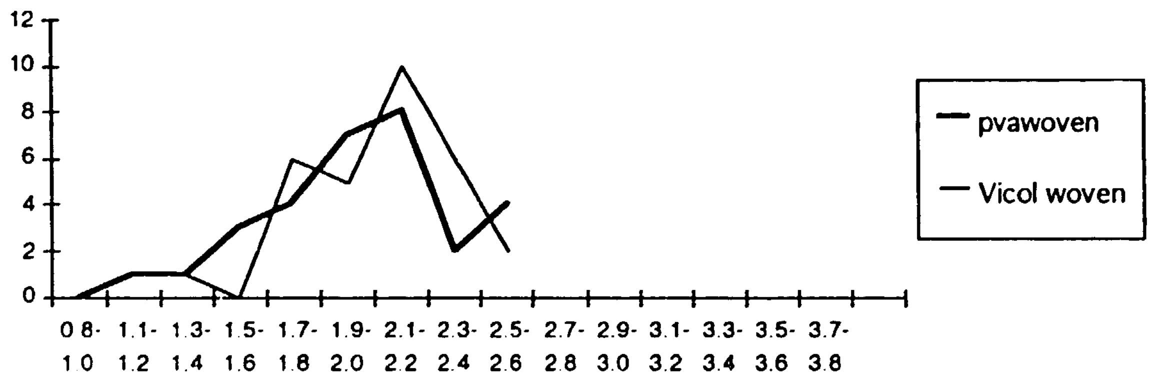
Graph 2 **Breaking Load in Newtons**

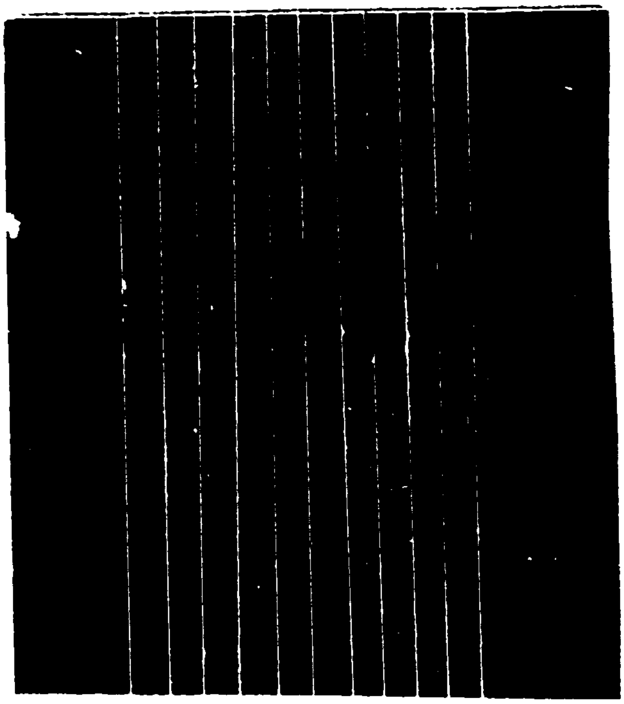


Graph 3 % Elongation At Break

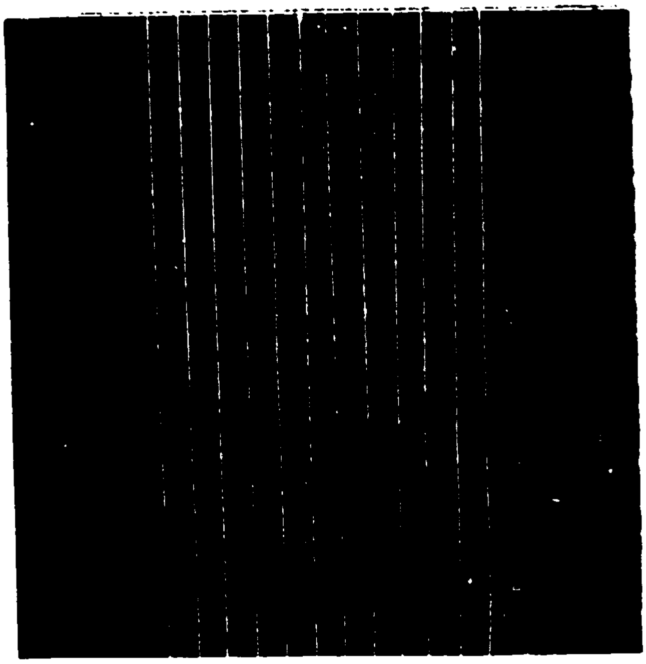


Graph 4 % Elongation At Break

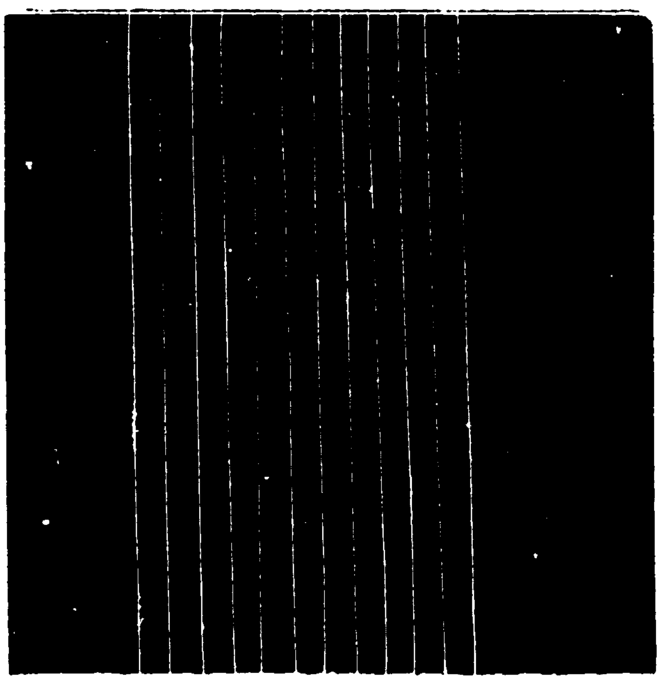




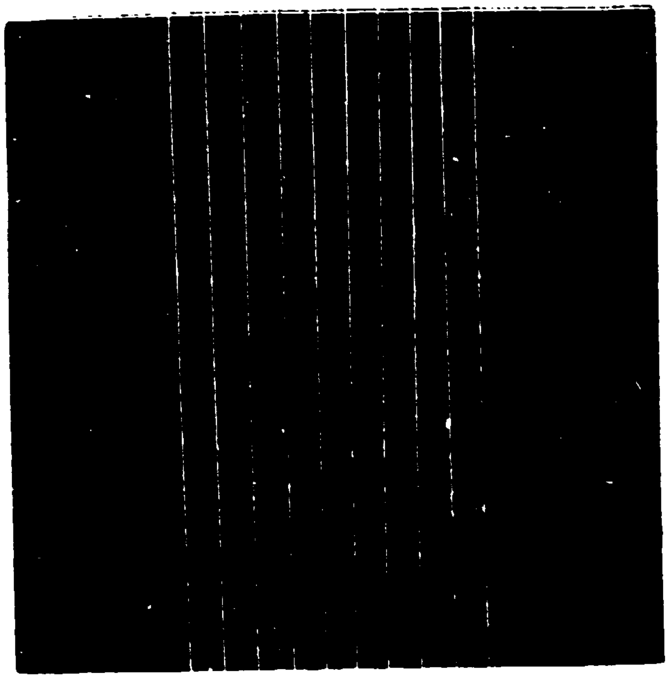
Unsized Ramie Yarn



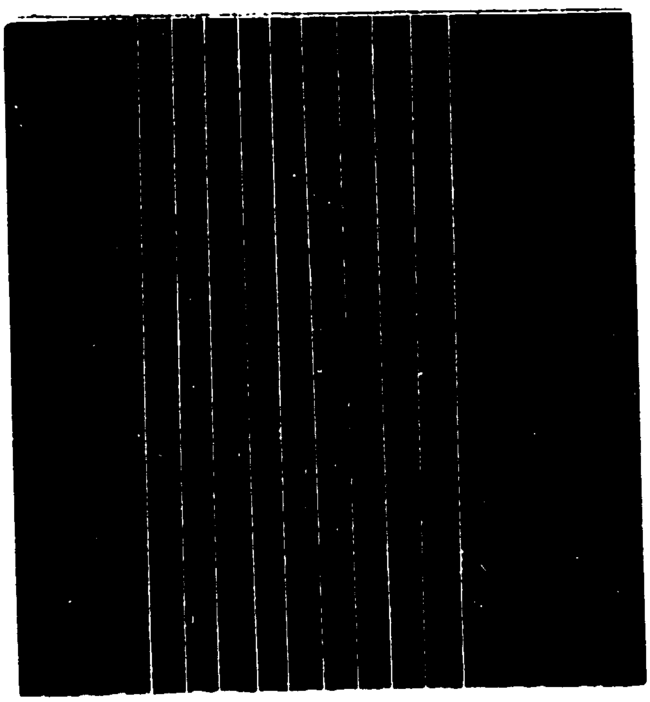
Yarn Sized With PVA etc. and Woven



Yarn Sized With Vicol etc. and Woven



Yarn Sized With PVA etc.



Yarn Sized With Vicol etc.

Allied Colloids

C O N F I D E N T I A L

TECHNICAL REPORT

Report No:	94/125 (A.J.M. 80)
Date:	25/02/94
Author:	DH/341/3/JAS
Department:	Textile Division Sizing Section
For the sole consideration of:	Hunan Ramie China
Title:	Determination of size loading and abrasion resistance of supplied Hunan Ramie

Summary:

The % size on supplied yarn samples was determined by enzyme desize method and was found to be 7.1% S.O.Y.

The abrasion resistance of the yarn was also determined and found to be good.

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Appendix 21 Cont.

2 EXPERIMENTAL/RESULTS

2.1 Size on Yarn Determination

Duplicate samples of the supplied sized yarn were scoured in a bath containing 1.5g/l^{-1} Nervanase 10x, 1.0g/l^{-1} Alcopol 650 at 70°C for 30 minutes, the temperature was then raised to 90°C for a further 20 minutes in accordance with Standard Method of Test S3.

Result = 7.1% Size on Yarn.

2.2 Abrasion Resistance

The supplied yarn was conditioned at 75% RH, 20°C for 48 hours prior to being abraded using the A.C. Eurotech Abrader under the following conditions:-

3000 Cycles
540° Yarn/yarn contact
20 gm/Thread tension

Result = 3000 cycles - No broken threads. The appearance of the yarn after abrasion was satisfactory.

3 CONCLUSION

The yarn appeared adequately sized and would be expected to give a satisfactory weaving performance.

.... D Hodgson

.... A Maliszewski
Laboratory Manager
Sizing Section

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7.1% SIZE ON YARN

Abraded on the A.C.Eurotech Abrader under the following conditions;

3000	Cycles
0	Broken Threads
540°	Yarn/Yarn Contact
20	gm/Thread Tension
75%	RH
20°C	Temperature

Appendix 21 Cont.

Appendix 21 Cont.

7.1% SIZE ON YARN

UNABRADED SAMPLE

Appendix 22

Results of Winding Studies, Spring 1994

Yarn Tensions In Winding, February 1994

16	13	13	13	8(12)	24	22	26(17)	16	15	16	20	14
14	13	19	13	25	20	17	19	19	17	16	19	15
13	15	22	23	14	13	12	15	15	25	19	19	22
21	20	19	19	20	19	11(17)	16	23	17	18		

Note:

1. Values are in cN.

2. Figures in brackets are after correction. After correction all heads carried an equal number of weights.

3. The values are lower than those in the earlier report due to a different measuring position.

Co-efficient Of Variation Measured Using Uster Evenness Tester

CV%	yarn on ring tube	22.3
	yarn on cone	24.1

ZhuZhou Winding Production Studies, Spring 1994

	Number of Stops		
Cause of Stoppage	Study 1	Study 2	Study 3
Trash	4	6	7
Fly	4	2	6
Slough off	-	1	-
Periodic slubs	2	10	14
Thick places	6	1	6
Double end	-	2	1
False stop	-	-	1
	—	—	—
Total	16	22	35
Stops per ring tube	0.16	0.22	0.35

During each study 25 spindles are observed as they each wind four complete ring tubes.

Winding Production Study Conducted During Author's Final Visit

Spindles studied	18
Duration	1 hour
Total ring tubes creeled	128
Total stops	20
Stops per ring tube	.15 6

The causes of stoppages were not recorded by all three observers and so are not included. The most frequent causes observed by the author were fly accumulation and slubs.

Masses and Dimensions of Twenty Cones

The dimension measured was the distance from the edge of the wooden centre to the edge of the package, at the base. Figures are in millimetres The masses are given in grams.

Size	Mass	Size	Mass	Size	Mass
65	1700	71	1820	74	1935
68	1635	71	1920	75	1865
69	1785	71	1930	75	1930
70	1700	72	1945	75	1940
70	1850	73	1810	77	2010
71	1815	74	1740	80	1985
71	1820	74	1850		

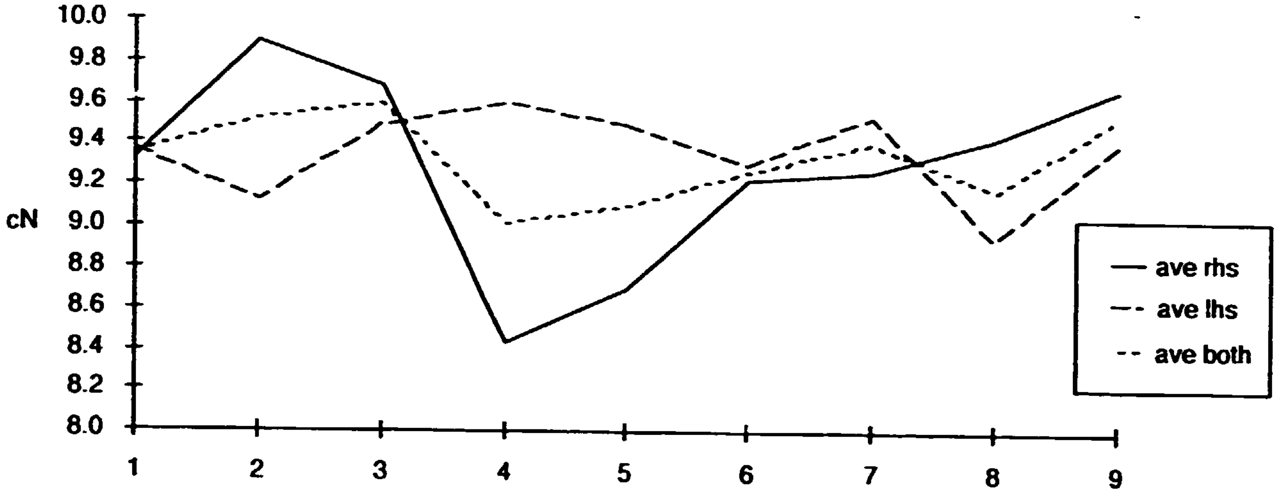
Masses, in grams, of Ten Wooden Centres

106	108	110	127	129
135	142	145	154	170

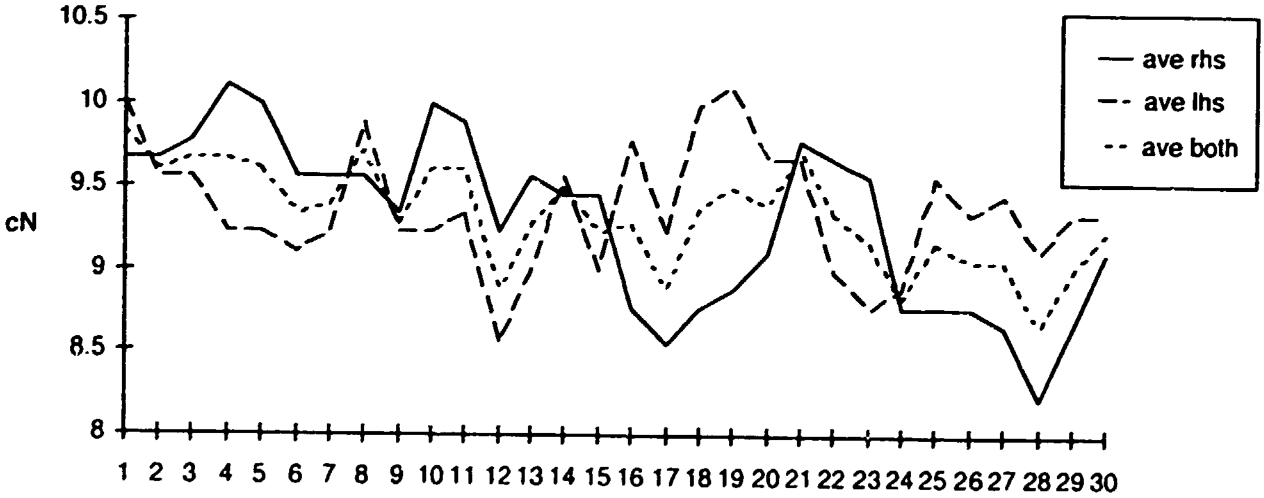
Results of Warping Studies, Spring 1994

Creel Tension Variation, Drum Warper

Variation By Height of Row



Variation in Tension from Front to Back of Creel



Warping Production Study, March 1994

	Occurrences
Failed transfer*	6
Break	4
Misaligned cone	1
Misshaped cone	1
Cobwebbing	1
Abraded during winding	1
Breaks per 10^6 metres	3.9

* It seems likely that these translate as 'Yarn abraded during winding' in the ZhuZhou studies.

Warping Records, ZhuZhou Mill

	Study 1	Study 2	Study 3	Study 4	Study 5	Study 6
Loose knots	1			1		1
Cobwebbed cone	1					
Long Hair	3	1				
Slubs	5	3	2			3
Yarn abraded during winding	3	6	6	4	13	4
Double end		1				
Bad knot				1		
Fly				1		
Other					2	1
	–	–	–	–	–	–
Breaks per 10^6 metres	5	4	4	3	6	4

Ongoing And Further Investigations In Weaving

1. Further Trials Of Restrictor Rods.

Stages

i) Manufacture three further sets of restrictor rods.

ii) Ensure weavers are aware of the purpose of the rods and the experiment.

iii) Fix rods to four adjacent looms, i.e two each from adjacent sets, which have full or almost full beams.

iv) Conduct two, two hour production studies per day on the eight looms which comprise the two sets (four with rods and four without), for ten days.

v) Analyse and compare data and fabric appearance, and canvass the views of weavers and overlookers.

vi) Repeat the experiment on rapier looms, but not until yarn preparation processes have been optimised.

2. Study Action Of Let-off Motion

Stages

i) Gait a new warp into an appropriate loom at the R.T.D.C.

ii) At full beam and every time 5 cm of flange are exposed:

a) Establish by experimentation the highest and lowest weight settings which can be used;

b) Weave two metres of fabric at highest and lowest settings and at one notch setting intervals in between;

c) At each setting measure the damped and peak running tensions, and record the reasons for warp stops.

d) For each sample, measure warp and weft setts, crimps and the fabric width;

e) Analyse results and make recommendations for optimum setting of the let-off motion.

Ongoing And Further Investigations In Winding

4. Optimise Clearer Settings

Stages

i) Record existing settings.

ii) Using Mr. Ye's measurements of co-efficient of variation (contained in appendix 22) as a guide, adjust settings, wind cones and record stoppages. This can be done on the idle side of the winding frame as only one side is in use at one time.

iii) Measure the co-efficient of variation for the wound cones and a selection of ring tubes.

iv) Repeat ii) and iii) as required.

v) Make recommendations as to the optimum settings.

vi) Use optimum settings for six complete shifts in order to wind enough yarns for a set of back beams.

vii) Conduct production studies in warping and weaving in order to compare performance with yarn wound using existing settings.

Ongoing And Further Investigations In Warping

4. Optimise Tensioner Settings, New Machine

Stages

i) On one side of the machine, set the middle tension disc to the lowest setting, creel a cone, thread the warp and run the machine so that the yarn is wound onto the beam. Measure the running tension.

ii) Move the cone to each measuring position and repeat. When necessary, adjust tensioner to ensure tension variations are minimised.

iii) Ensuring that misshapen cones are avoided, warp a set of 36's ramie and record performance.

Ongoing And Further Investigations In Sizing

4. Optimise Process Control

Stages

i) Record existing situation, i.e: check alignment of back beams in creel; measure tension of ends from different back beams when full, half full, and near empty; measure size viscosity and temperature at half hour intervals during the sizing of a set of weavers beams; record cylinder temperature and pressure, moisture regain, and squeeze roller pressure at half hour intervals; record stretch setting and measure stretch; count the number of ends in each dent in the reed. Mark the beams with an identifying code.

ii) Use production studies to record warp stoppages in weaving.

iii) Ensure that necessary maintenance is carried out so that the sizing machine is in optimum condition.

iv) Size a set of beams ensuring that the control points in i) above are optimised, and that the ends are counted into the reed rather than 'dropped in' as is the present practise. Mark the beams with an identifying code.

v) Use production studies to record the warp stoppages in weaving.

vi) Compare the results of the production studies.

vii) Discuss the results with the operatives concerned.

4. Evaluate Vicol/Corn Starch Size

Stages

i) Obtain necessary ingredients and recommendations as to sizing conditions, preferably from Allied Colloids Ltd. since they have already conducted related experimental work.

ii) Size a set of beams using the new size mix and identify the beams.

iii) Use production studies to record the warp stoppages in weaving.

iv) Compare the weaving performance against that normally obtained.

v) Repeat if necessary (it is unlikely that the best results will be obtained at the first attempt).