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Study on the effects of back rest roller height of warp yarn breakages with asymmetric sheds.

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Abstract

Maintaining fabric quality and conformity of the fabric parameters as per buyer's requirement are very challenging job in the weaving industries. During weaving, there are various factors that affect weaving performance leading poor quality of the fabric as well as nonconformance in the constructional parameters. Warp breakage during weaving is an important aspect that can deteriorate fabric quality. Improper backrest height is an important weaving parameter that affects warp breakage leading to loss of fabric quality. The work reported here in this paper demonstrates this aspect of weaving process e.g. study on the effect of back rest roller height on the warp breakages for using finer yarns while asymmetric sheds. In this regard fabrics were woven using 40^s ,50^s and 60^s yarns (both warp and weft) at several back rest height position (0 to +10cm) and warp breakages was studied. To produce the fabrics Picanol OptiMax rapier loom was used with asymmetric cam shedding mechanism. The results show that the back rest height has significant effect on the warp breakages during weaving. Least breakages were found when the back rest roller was at 6cm to 10cm positions upper from the reference line. The results are then represented in tabulated and graphical forms with the analysis.

Key-words: Weaving, warp yarn, breakage, back rest roller, asymmetric shed

"1. Introduction"

Woven fabrics are the ancient and most aristocratic mean of weaving. The woven fabrics are produced the machine called "loom". Loom has different setting areas which are needed to be changed when the fabric designs and constructions are changed.

On a weaving loom, warp yarn are divided into two half to make up a shed. This division makes up a specific geometry of divided warp yarns, called "Shed Geometry". Shed Geometry plays vital role in controlling warp yarns & tension, elongation and friction between them resultantly this helps in controlling weft density of fabric by controlling pick penetration, warp and weft yarn breakages and loom stoppages, hence machine Efficiency. Components that may part of the shed geometry of may contribute to it are: frame height, frame depth, cloth support (front rest) height, back rest (and deflecting roller) height and depth, virtual shed dividing line, dropper box adjustment and droppers movement, top shed line, bottom shed line, front shed, rare/back shed.

Most of the high speed modern looms are operated with cam shedding motion- either symmetric or asymmetric. But the later one is preferred because of the higher scope of design variety. In our country, almost all the looms are running with asymmetric cam systems. The most disadvantageous feature of the asymmetric cam system is the higher tension in the top warp shed. This higher tension occur higher breakages. While dealing with finer yarns and plain weave in such asymmetric cam motions, the setting in the warp shed geometry is needed to be changed so that minimum warp breakages occur. The easiest mean of changing the warp shed geometry is to change the position of the back rest roller.

The main purpose of this work is to show the optimized setting of the backrest roller to minimize the warp breakage thus stable weaving.

"2. Literature Cited"

The vertical and horizontal position of the back rest influences the shed geometry. As known, the raised back rest gives better spreading of warp ends on the face of the fabric. If the back rest is horizontally away from the heald, the tension per unit length of the warp ends is reduced. That is why for silk and filament weaving the back rests are away from the healds as compared to their positions for cotton weaving.

• BTRA studies [1] have shown the scope for improving productivity and quality by varying the vertical and horizontal positions of the back rest. For non-automat looms weaving plain cotton fabric, the back rest is given an oscillating movement by means of a cam on crank shaft through a lever to ease the warp threads during shedding. The effect of loom parameters on properties of fabrics has been studied by a number of research workers. Joshi [2] has made the following observations unless otherwise stated while weaving a plain cotton fabric with 32 epc, 33 ppc, 2/60 Ne warp and 2/60 Ne weft on Northrop Vicker Stafford Loom.He found the following observations:

• Raising the back rest to 25 - 50 mm above the normal height reduces the warp crimp, increasing the welt crimp. Lowering of the back rest below the normal height increases the warp crimp decreasing the weft crimp ,Positioning of back rest does not have any effect on breaking strength of fabric, The fabric elongation at break, both warp and weft is affected by a change in the back rest position. Similar observations have been made by Salem and Natarajan [3].

• Lyer [4] has found that the back rest position has greater influence on thread crimps than shed timing. According to Agarwal [5] both earlier shedding and raised back rest give higher limit of weft packing density however, the former is more effective than the later, when used alone. Joshi, Salam and Natarajan have observed that the warp way fabric strength is not effected by change in shed timings.

During the process of weaving , the warp yarn is subjected to a complex action consisting of extension, abrasion and bending [6,7,8]. Maximum abrasion takes place in the heald eyes whilst the deflection of the yarn and its movement in a plane at right angles to the plane of the heald eye intensify the abrading action. Lord [9] found that early shedding gives a low warp tension but the amount of abrasion is maximum. The race board rubs the threads on the bottom shed line and the shuttle abrades the warp yarns in the longitudinal and transverse direction. Wear of the warp yarn by abrasion increases with the increase in warp and weft density of the cloth.

The mechanical condition of loom parts which directly come in contact with the warp and settings of loom motions and mechanisms have a great influences on the warp breakages. Some important factors as recommended by BTRA [10]are as follows: depth of the shed & shed timing: More depth of shed than necessary and too early shed timing lead to a high number of warp breaks.

Effect of cam asymmetry on fabric formation was further explained by Stubli [11],a famous shedding cam manufacturer. Some of their results are mentioned below-

Symmetrical cam
Ft = Fb

Asymmetrical cam
AL 20 Ft = 1,17 x Fb
AL 40 Ft = 1,3 x Fb

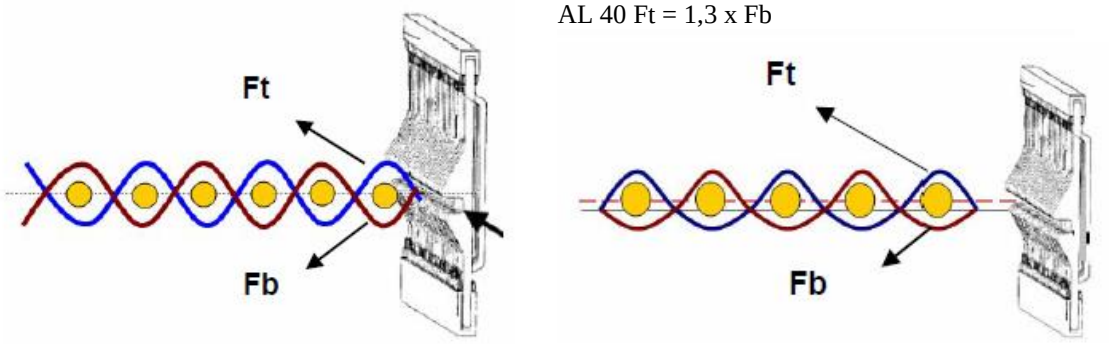

Figure 1: Distribution of warp tension for both symmetrical and asymmetrical sheds

"3. Methodology"

To conduct this work, fabrics were prepared fabric with same yarn density but yarn count was different. The fabric parameters are shown as tabulated below:

Fabric parameters:
The fabric particulars are tabulated below.

Table 1: Fabric parameters used in the experiment

Sl No	EPI	PPI	Warp Count (Ne)	Weft Count (Ne)	Fabric Width (inch)	Weave Type
1	100	90	40	40	36	1/1
2	100	90	50	50	36	1/1
3	100	90	60	60	36	1/1

Yarn parameters:
The yarns have the following criterion which are shown in a tabulated form.

Table 2: Yarn parameters used to produce the fabrics

Specification	40 Ne	50 Ne	60 Ne
Actual count	40.56	50.44	60.61
CV%	0.66	.69	0.77
IPI	74	86	97
CSP	2975	2910	2842
E%	8.93	8.67	8.77
TPI	26.56	29.69	32.53
Fiber MIC Value	4.4	4.4	4.4
Fiber Staple Length(mm)	30	30	30
Type	Comb	Comb	Comb

The warping was done by Karl Mayer High Speed warping machine. Sizing was done by Karl Mayer Slasher sizing machine which is originated from Germany. The size take-up percentage was 11% to all of the warp yarns and to weave the fabric Picanol Optimax which is one of the latest weaving machine was used.

"4. Results & Analysis"

Table 3: Breakage of different yarns when shed angle is 26°

Sl No.	Back Rest Position	Shed angle in °	Time	Yarn count	Breakage number	Yarn count	Breakage number	Yarn count	Breakage number
1	0	26	1 hr	40 Ne	11	50 Ne	14	60 Ne	17
2	1				8		11		14
3	2				6		10		9
4	3				5		7		8
5	4				3		4		5
6	5				3		4		5
7	6				1		4		3
8	7				0		3		3
9	8				0		3		4
10	9				1		4		4
11	10				2		4		4

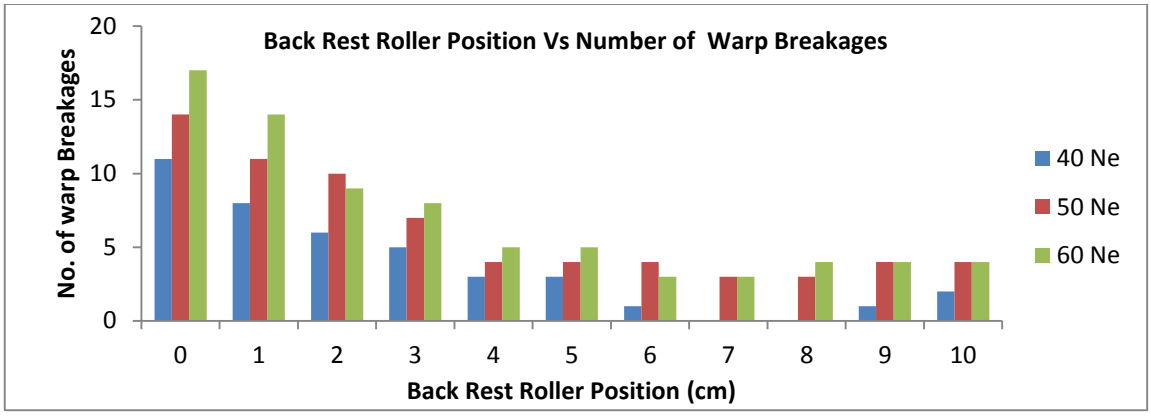

Figure 2: Graphical representation of warp breakages when shed angle is 26°

Table 4: Breakage of different yarns when shed angle is 28°

Sl No.	Back Rest Position (cm)	Shed angle in °	Time	Yarn count	Breakage number	Yarn count	Breakage number	Yarn count	Breakage number
1	0	28	1 hr	40 Ne	12	50 Ne	14	60 Ne	18
2	1				10		11		14
3	2				9		11		9
4	3				6		7		7
5	4				5		5		6
6	5				5		5		4
7	6				3		4		4
8	7				1		4		4
9	8				0		3		3
10	9				0		4		3
11	10				2		4		4

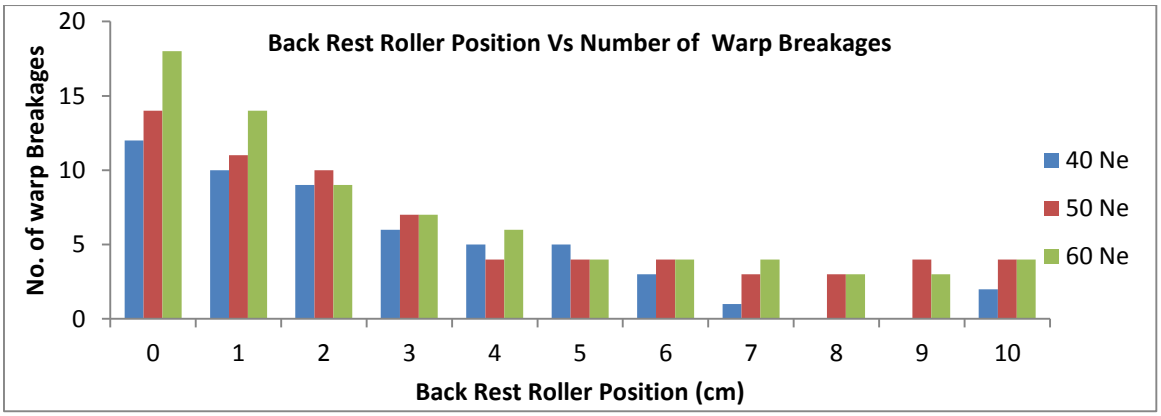

Figure 3: Graphical representation of warp breakages when shed angle is 28°

Graph 1,2,3 is showing the comparative breakage status of 40 Ne,50Ne,60,Ne warp yarn at shed angle 26° and 28° respectively. From the graph it is clear that when the shed angle is 28° the warp breakages are more. This may be due to the greater stroke length of the heald frames for 28° shed angle. From these graphs it is clear that minimum warp breakages were found at the back rest roller position 7cm,8cm,9cm above the centre line (8cm & 9cm for 40ne & 60ne yarns respectively whereas 7cm & 8cm for 50ne yarns). To explain this phenomena, amathamatical model calculation was done result of which is shown as table below.

Table 5: Percentages of warp strain for different sheds.

Shed Type	Strain on Top Shed	Strain on Bottom Shed
Symmetric Shed	0.725%	0.725%
Asymmetric Shed with back rest roller position at 0	1.81%	0.11%
Asymmetric Shed with back rest roller position at +5	1.52%	0.339%

From the table 5.8, 5.9 and graph 5.11, 5.12 it is clear that as the yarn is becoming more finer the number of warp breakages are more. This may be due to the yarn strength.40 Ne yarn has more strength than to 50 Ne and 50 Ne has greater than 60 Ne warps. So the warp yarn with 40 Ne yarn count have least breakages and 60 Ne having the maximum.

"5. Conclusion"

In this work it was tried to show the effect of the position of back rest roller on warp breakage while using the asymmetric cams. From this work it was found that position of the back rest roller has significant effect on the warp breakages. While the back rest roller was at the bottom position i.e at 0 line the shed was strongly asymmetric and strain on the top shed was maximum. So the number of warp breakage was also maximum. With the back rest roller moving upwards the effect of shed asymmetry reduces so as the warp breakage. So it can be recommended that while using asymmetric cams, the back rest roller should be in higher position i.e. back rest height should be greater so that the yarns in the top shed have least tension so as least warp breakage.

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