Influence of Cradle Spring Setting On Ring Yarn Quality

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Abstract

Yarn ring spinning frame Technology is a simple and old technology, but the production and quality requirements at the present scenario puts in a lot of pressure on the technologist to select the optimum process parameters and machine parameters, so that a good quality yarn can be produced at a lower manufacturing cost. The ability of the spinner to keep the imperfections down and in turn reduce the yarn irregularities is gaining much importance in this era of stringent quality norms. This study deals with the effect of ring frame cradle spring tension on top apron slippage reflecting the ring frame yarn quality. When mechanical faults were kept down to a minimum, irregularities in drafting raised mainly due to ineffective movement of fibres in the main drafting zone. In the drafting system mainly aprons are used to have a control on floating fibres but necessarily the aprons must rotate with same speed as that of the middle roller, but the aprons are lagging with little bit speed called as "apron slippage". In the actual working apron slippage is generally occurs due to some of the mechanical limitations, of which the cradle spring tension is also a one of the limitation.

Key Words – Apron, Cradle, Draft, Top arm, Twist Multiplier, Roving and Imperfections.

I. Introduction

For the technological development of drafting system on ring frame in order to enhance the yarn quality machine and material parameters are considered. In the machine parameters form of drafting system, top arm loading, drafting elements and drafting driving arrangement were introduced. The object of draft form is controlling fibers effectively, reducing floating zone length, drafting stably. Draft pressure mechanism develops from saddle weighting to pneumatic weighting. Spinning property of draft element such as roller, top roller, apron and so on were improved to reach the demands of new type draft form and processing. Development of draft driving is reasonably, stably, quickly and easy maintenance, electronic draft system is generated. For controlling the floating fibre, the main element is responsible is the apron. Mainly the top apron is controlled by the cradle, which is acting as a path for apron movement. This study deals with the cradle condition deciding the apron movement and finally the yarn quality. Following figure 1 shows the cradle from the ring frame drafting system.

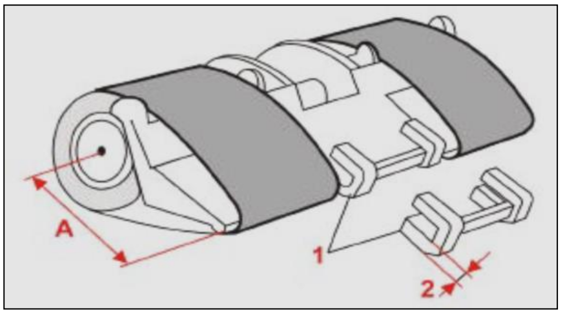

FIGURE 1

II. Material and method

In this research study cotton yarn of 32s Ne was produces for testing the effect of cradle spring tension setting on the yarn quality parameters. The yarn samples have been made on the different spindle numbers as: 228, 607, 608, 743, 744, 855 and 858. Following table 1 shows that the process parameters used for producing the above mentioned yarn.

TABLE 1 PROCESS PARAMETERS

Parameters	
Raw material	H4
roving hank	1.00
Roving T.M.	1.45
Yarn T.M.	4.30

Spindle speed (rpm)	17000
Top arm pressure (kg/cm^2)	18/14/16
Cradle Size (inch)	36
Apron Size (mm)	37x27.8x1

In this study the yarn was produced on different spindles for before and after the cradle tension setting. Generally by the continuous working the cradle becomes loose and the same yarn was taken as a sample 1 and after tightening the cradle spring another sample 2 was taken and by the comparative study an attempt was made to show the importance of cradle setting for enhancing the yarn quality.

During taking the cradle setting trials the top apron surface speed has been tested by the tachometer for mm/min reading and by using the following two formulae the apron slippage has been calculated and only top apron slippage was considered for this study.

1. $$Top\ apron\ slippage(Sa) = \frac{\left[\begin{matrix}(surface\ speed\ of\ bottom\ apron)\\ -(surface\ speed\ of\ top\ apron)\end{matrix}\right]}{Surrface\ speed\ of\ bottom\ apron} X100$$

2. $$Bottom\ apron\ Slippage(Sb) = \frac{\left[\begin{matrix}(Surface\ speed\ of\ middle\ bottom\ roller)\\ -(Surface\ speed\ of\ bottm\ apron)\end{matrix}\right]}{Surface\ speed\ of\ middle\ bottom\ roller} X100$$

III. Results and Discussion

1. Effect of Cradle Setting on Top Apron Slippage -

The apron slippage at the different spindle heads of above mentioned spindle numbers have been tested before and after the cradle setting and an attempt have been made for testing the reduction in apron slippage due to the setting of cradle spring.

The following table 2 shows the percentage of apron slippage for above mentioned spindles before and after the cradle setting.

TABLE 2 % APRON SLIPPAGE W. R. T. CRADLE SETTING

Spindle Numbers	Apron Slippage %		% Reduction in Apron Slippage
	Before	After	
607	3.98	2.43	39
608	4.25	2.85	33
743	4.51	2.50	45
744	4.27	2.44	43
855	4.39	2.69	39
856	4.37	2.78	36

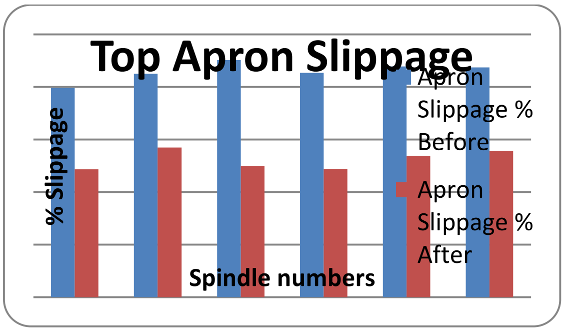

FIGURE 2

From the above table 2 and figure 2 it is confirmed that, there is a dominant reduction of average 42% in the top apron slippage after the cradle setting due to the increase in frictional force between the middle bottom roller and the apron, leading to the increase in amount of drive transmission. After the cradle setting the top apron path on the cradle is made smooth and slight tension is given in the apron so far the apron will not becomes slack and will move smoothly.

The statistical analysis of data given in table 2 shows that, the ‘P’ value for top apron slippage before and after the cradle setting is 1.83E-08 which is less than 0.05, confirming that there is significant difference between the top apron slippage before and after the cradle setting.

2. *Effect of Cradle Setting on Yarn Imperfections -*

For testing the imperfections of yarn samples produced before and after the cradle setting for above mentioned spindle numbers are as given in the following table 3 and the percentage reduction in each imperfection is as given in the table 4.

TABLE 3 YARN IMPERFECTIONS

Spindle Numbers	Before Setting					After Setting				
	U%	Thin	Thick	Neps	**Total**	U%	Thin	Thick	Neps	**Total**
607	16.1	345	1115	655	**2115**	13.44	40	260	335	**635**
608	16.12	205	1150	665	**2020**	12.82	25	325	390	**740**
743	14.68	100	790	570	**1460**	13.23	36	365	375	**776**
744	16.03	330	1080	630	**2040**	12.99	30	305	310	**645**
855	15.66	245	1140	815	**2200**	12.7	5	260	406	**671**
856	15.47	125	575	625	**1325**	13.37	15	400	360	**775**

TABLE 4 PERCENTAGE REDUCTION IN YARN IMPERFECTIONS W. R. T. CRADLE SETTING

Spindle Numbers	Thin Places			Thick Places			Neps		
	Before	After	% Reduction	Before	After	% Reduction	Before	After	% Reduction
607	345	40	88	1115	260	77	655	335	49
608	205	25	88	1150	325	72	665	390	41
743	100	36	64	790	365	54	570	375	34
744	330	30	91	1080	305	72	630	310	51
855	245	5	98	1140	260	77	815	406	50
856	125	15	88	575	400	30	625	360	42

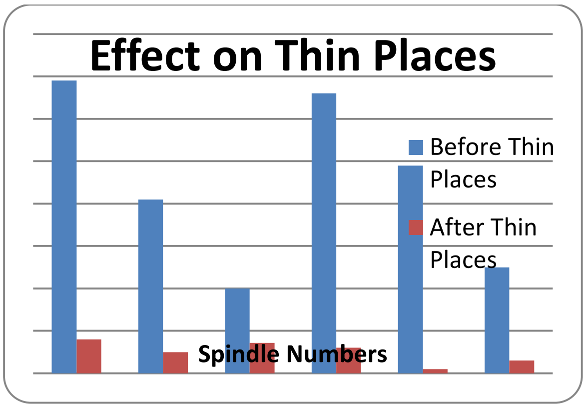

FIGURE 3

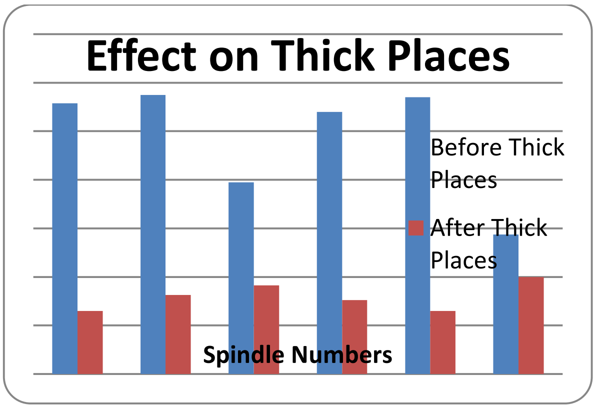

FIGURE 4

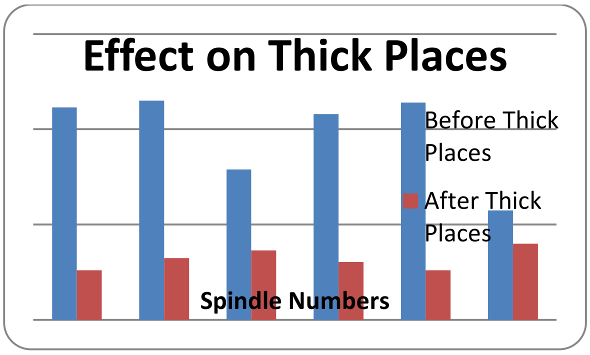

FIGURE 5

Table 3-4 and figure 3-5 reavels that, after the cradle setting the thin places of the yarn are reduced dominantly by 85% it is because of smooth movement of the top apron during drafting. The thick places of yarn after the cradle setting are found to be reduced approximatly by 72% while the neps are reduced by 50% which is due to the reduction in dusturbance to the material during drafting.

The reduction in thin palces is more dominant because of frequent disturbance to the material during drafting at main drafting zone. The thick places reduction is72% it is due to accumulation of fibres at one place.

The statistical analysis of the data given in table 4 confirms that, the 'P' value for thin, thick and neps are 0.000761, 6.28E-05 and 1.08E-05 respectively and those are less than 0.05 reflecting to there is significant difference between the thin, thick and neps befere and after the cradle setting. The 'P' value is found to be reduced from thin places to neps confirming that the percentage reduction in neps is less than thick places and thick places is less than thin places.

3. Effect of cradle setiing on yarn Unevenness % -

The yarn samples prepared on same above mentioned spindles are tested on Uster tester for yarn unevenness and the results obtained are as given in the following table 5.

TABLE 5 IMPROVEMENT IN YARN U% W. R. T. CRADLE SETTING

Spindle Numbers	Before Setting	After setting	% Reduction
607	16.1	13.44	17
608	16.12	12.82	20

743	14.68	13.23	10
744	16.03	12.99	19
855	15.66	12.7	19
856	15.47	13.37	14

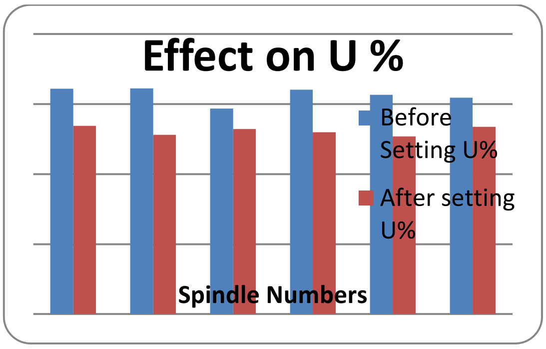

FIGURE 6

Above table 5 and figure 6 confirms that, the yarn unevenness is reduced by average 19% after the cradle setting. This ia because when the cradle setting is done the path provided for top apron becomes slightly tight and the apron slackness is removed resulting to the effective control on the floating fibres by reducing the drafting wave.

The statistical analysis of data given in table 5 proves that, the 'P' value for U% before and after the cradle setting is 1.55E-06 which is less than 0.05 confirms that thee is significant difference between the U% values before and after the cradle setting.

Conclusions

This study confirms that, there is a dominant reduction of average 42 % in the top apron slippage after the cradle setting due to the increase in frictional force between the middle bottom roller and the apron by improving the amount of drive transfer.

It is also found that after the cradle setting the thin places of the yarn are reduced dominantly by 80% to 85%and the thick places of yarn after the cradle setting are found to be reduced approximatly by 72% while the neps are reduced by 50% which is due to the reduction in dusturbance to the material during drafting. The reduction in thin palces is found to be dominant because of frequent disturbance to the material during drafting at main drafting zone. The thick places reduction is72% it is due to accumulation of fibres at one place.

After the cradle setting the path provided for top apron becomes slightly tight and the apron slackness is removed resulting to the effective control on the floating fibres by reducing the drafting wave so far the yarn unevenness is reduced by average 19%.

The statistical analysis of the data collected in the research study confirms that, the 'P' value for Apron Slippage, Thin, Thick, Neps and U% are less than 0.05 reflecting that there is significant difference between the thin, thick, neps and U% befere and after the cradle setting. The 'P' value is found to be reduced from thin places to neps confirming that the percentage reduction in neps is less than thick places and thick places is less than thin places.

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