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Research Article

Influence of Pin Spacer on Yarn Quality in a Ring Frame

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Abstract

Spacer is used to introduce the distance between lower edge of the top cradle and bottom apron nose bar which determines the distance between top and bottom aprons. This in turn determines the intensity of pressure applied to the fibers to be under control. Again, pin spacer is made of spacer of different sizes and pin of different heights. Pin that is adjusted on the spacer represents an additional deflection point in the yarn path through the drafting system. In the experiment, 20 tex yarn was produced each time using spacer without pin and using pin spacer. Firstly, spacers of different sizes were used. Then pins of different heights were adjusted with the same spacers and these pin spacers were used to produce yarns. Finally, the properties of the produced yarns were compared in order to analyze the influence of pin spacer on yarn properties in the ring frame.

Keywords: *Ring frame, Spacer, Pin spacer, Yarn, Yarn properties*

1. Introduction

The textile industry is primarily concerned with the production of yarn and cloth. Yarn is a product of substantial length and relatively small cross-section consisting of fibers or filaments with or without twist (M.J. Denton and P.N. Daniels, 2010-2011). After industrial revolution, ring spinning system has been widely used to produce yarn as there are significant advantages available in this system. It is a universally applicable system through which yarn of any required fineness with optimal characteristics, specially, with regard to structure and strength can be produced (W. Klein 1995). In the main drafting zone of ring frame where the fleece of fiber material is attenuated to a greater extent, the fibers are guided up to the front roller nip by means of top and bottom aprons. Spacer is used to introduce the distance between lower edge of the top cradles and bottom apron nose bar which determines the distance between top and bottom aprons. This in turn determines the intensity of pressure applied to the fibers to be under control (K Buvanesh Kumar, R Vasantha Kumar and Dr. G Thilagavathi 2006). On the other hand, pin spacer is made of two components. Basis is the spacer which is available in different sizes and the pin which is available in different heights. When this pin is adjusted with spacer, it is called pin spacer. Due to using the pin, there is an additional deflection point in the yarn path through the drafting system; as a result, the drafting process tends to be hampered unlike using standard cradle spacer. So, pin spacer should be chosen with an apron nip which is usually one step bigger than the standard cradle spacer. In the experiment, 20 tex yarn was produced. Firstly, spacers of different sizes but without pins were used to produce yarn. Secondly, the same spacers adjusted with pins of different heights were used for the yarn preparation. After production, all the samples were conditioned at standard testing atmosphere and then tested. After testing, the tested results were compared to analyze the influence of pin spacer on yarn quality in a ring spinning frame.

2. Material

The raw material that was used to produce yarn was the roving of 100% cotton fiber. The fineness of the roving was 599 tex. This roving was used as a feed material in a ring frame for producing the sample yarn.

Machine and Parts

Ring frame

Ring frame of Cetex "Laboratory Spinning Unit LSE 2000" was used in the experiment. Out of six spindles, the best four performing spindles were used. Following spinning parameters were set up during the production of yarn.

Table 1: Spinning parameters of the ring frame

Parameters	
Spindle speed	15000 rpm

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TPM	755
Drafting device	3-over-3, spring loaded
Roller setting	45x65 mm
Compact device	EliTe^{R}

Spacer and Pin spacer

Suessen spacers and pin spacers were used in the experiment. Five different sizes of spacers (in respect of apron nips) according to five different colors were used as below.

Table 2: Spacers with color and Nip dimensions

Color	Apron Nip (Mm)
Pink	2.75
Red	3.00
Orange	3.25
Brown	3.50
Grey	4.00

Fig 1: Spacers with different colors

Again, five pin variants were differentiated by their pin positions which were higher or lower by the step of 0.25 mm. When these pins were adjusted with the above spacers, they were used as pin spacers. Different pin positions (in respect of heights) according to different colors were as below.

Table 3: Spacers with color and Height dimensions

Color	Height
Red	-0.50
Orange	-0.25
Green	0.00
Pink	+0.25
Light blue	+0.50

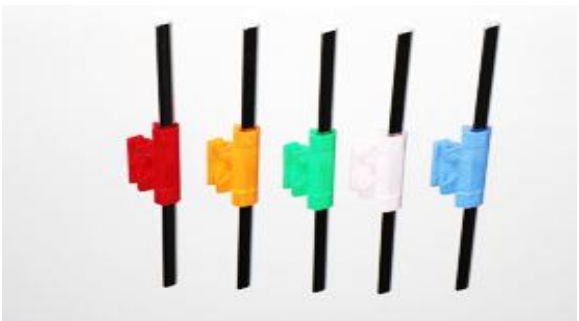

Fig 2: Pins with different colors

3. Method

First of all, 20 tex yarns were produced using spacers of different sizes from roving in the ring frame. Then 20 tex yarns were produced again using the same spacers attached with pins of different heights. After production, all the samples were conditioned for 24 hours. Then the samples were tested at standard testing atmosphere. The 'Keisokki Evenness Tester 80' was used to measure the CV% for yarn evenness with testing speed of 200 m/min.

4. Results and Discussion

Among all the test results, the results of the spacers without (w/o) pin and the respective best results of the pin spacers were summarized in order to analyze the influence of pin spacer on yarn properties. In this case, average CV% for yarn evenness of four spindles was considered for each trial.

CV% for yarn evenness against different spacers

If average CV% for yarn evenness of four spindles of the ring frame against different spacers are considered then following diagram is obtained.

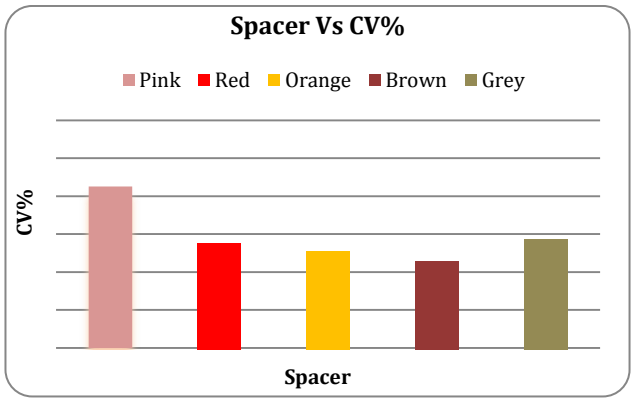

Fig 3: CV% for yarn evenness against different spacer

From the above figure, it is clear that yarn with the best evenness is obtained in case of using brown spacer (3.50 mm). Because this spacer determines the suitable distance between lower edge of the top cradles and bottom apron nose bar during the production of 20 tex yarn. On the other hand, the worst result has come when using pink spacer (2.75 mm).

CV% for yarn evenness against different spacers and pin spacers

If CV% for yarn evenness using different spacers and the respective best results of different pin spacers are considered, then the following graph is obtained.

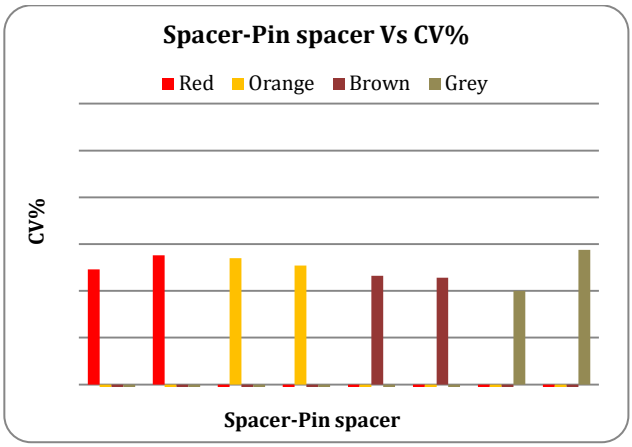

Fig 4: CV% for yarn evenness against different spacers and pin spacers

In this case, pink spacer has not been considered as it was not possible to produce yarn when using pins of different heights with pink spacer due to frequent breakages of fiber strand at the drafting zone. This might be for more pressure on fiber material.

However, from the above bar chart, it can be said that the best result is obtained when using grey pin spacer. But there are no significant differences between spacers and pin spacers in case of using other spacers and pin spacers.

It is also noticeable that when spacer width is higher, i.e., grey spacer (4.0 mm), then better result comes with lower pin position (+0.50) and when spacer width is lower, i.e., red spacer (3.0 mm), then better result comes with higher pin position (-0.50). Because, these positions determine the more perfect distance between top and bottom apron which creates suitable pressure on the fibre strand at the front drafting zone of ring frame.

Conclusion

In the experiment, influence of pin spacer on yarn quality in a ring frame has been discussed. The best result has been obtained in case of using pin with grey spacer that means using grey pin spacer. This is due to the perfect distance between top apron and bottom apron which causes more suitable pressure on the fiber strand at the front drafting zone. As a result, there is better control of fiber in this zone and finally improved quality of yarn is produced.

References

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