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EFFECT OF FALSE TWIST AT THE DRAFTING ZONE OF RING FRAME

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Abstract

At the drafting zone of ring frame, there is high airflow between the drafting rollers due to high movement of rollers, specially, at the front drafting zone. So, when fiber strand of sliver moves through the 4-over-4 drafting rollers in a ring frame, some parallel fibers can go inside the nip of rollers, but some cannot go due to uncontrolled fibers. If any false twist, for example, firstly 'Z' twist, then 'S' twist are inserted on the fiber strand at the second pre-draft zone of the drafting system using a false twist device, there will be more compacting of fibers in this zone. As a result, more controlled fibers will be available at the front apron drafting zone which causes good impact on yarn quality. Again, different false twists in different times have different impacts on the fiber strand for which width of spinning triangle becomes different and this causes the significant impact on yarn quality.

Keywords : Ring frame, Drafting, False twist, Spinning triangle, Yarn quality

Introduction

The ring spinning frame is the most widely used form of spinning machine to produce yarn from short staple fibers due to significant advantages in comparison with the new spinning processes (Klein, 1995). Among the different parts of the ring frame, the drafting zone is the most important as any draft and drafting field produce irregular movements of fibers (Nemzer, 1961) and best properties of the spun yarn are generally related with high values of drafting force (Audivert *et al.,* 1967). Usually, fiber material in the form of roving is supplied in the drafting zone of a ring frame and normally drafting system contains three sets of drafting rollers (3-over-3 drafting system). But in case of feed of sliver instead of roving in drafting zone, it needs higher draft in order to form yarn directly from sliver and causes the bad impact on yarn quality. So, four sets of drafting rollers (4-over-4 drafting system) in drafting zone are suitable in this case to reduce this bad impact.

Again, sliver is an assemblage of fibers in continuous form without twist (Denton *et al.*, 2011). Due to high movement or revolution of the drafting rollers, specially, in front zone, there is also high airflow between the rollers. As a result, when the sliver goes towards the drafting rollers, some parallel fibers can go inside the nip of rollers, but some cannot go. These fibers cause the irregularity in yarn and produced yarn becomes less uniform. If it is possible to insert false twist, i.e., firstly 'Z' twist and then 'S' twist on the

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fiber strand of the sliver between the drafting rollers, then there will be more compacting of fibers because of false twist and in this case, more regular and more uniform yarn can be produced. Again, false twists in different times have also the significant influence on spinning triangle which is a critical area in the spinning process of staple yarn in influencing the spun yarn properties (Feng *et al.,* 2010).

In the experiment, a device named 'False Twist Aggregate' was used with an oblong key to insert false twists with different times on the fiber strand of sliver at the second pre-draft zone of four sets of drafting rollers and 20 tex yarn was produced at each time. During the production, width of spinning triangle was measured for each trial. After production, yarn quality was measured and the properties, i.e., CV% for yarn evenness and yarn strength were analyzed and finally the results of different trials were compared to find out the optimum false twist in respect of time.

Material

The raw material that was used to produce yarn was sliver. This sliver was composed of cotton and polyester fibers. 80% US-Pima cotton was mixed with 20% polyester to make the sliver. Staple length of fiber in the sliver was 34.39 mm and fineness of sliver was 4100 tex.

Machine and Device

Ring frame

The ring frame that was used for the preparation of yarn from sliver was "Laboratory Spinning Unit LSE 2000" of Cetex. It had six spindles in total, but only spindle no-6 was used in the experiment. Suessen HP-drafting system, i.e., HP-GX 4010 (4-over-4 drafting system) was used. Different related parameters which were set up are shown in Table 1.

Table 1. Different related parameters of the ring frame

Parameters	Amount
Spindle speed	10000 rpm
Delivery speed	12.5 m/min
TPM	800
Spacer size	3.25 mm
1^{st} (front) to 2^{nd} bottom roller	45.50 mm
2^{nd} to 3^{rd} bottom roller (2^{nd} pre-draft zone)	50 mm
3^{rd} to 4^{th} bottom roller (1^{st} pre-draft zone)	53 mm
Shore hardness of back cot roller	83º
Shore hardness of front cot roller	63º

Here, optimum spindle speed and delivery speed were set up and these were 10000 rpm and 12.5 m/min respectively. TPM and spacer size were taken in respect of yarn fineness. Bottom roller settings were adjusted according to the fiber length of sliver.

'False Twist Aggregate' device

The device that was used to insert false twist on the fiber strand was named as 'False Twist Aggregate'. It was a new device, but an important part to accomplish the experiment. An oblong key was positioned at the one end of the device (as shown in Fig. 1). On the other end of the device, there was a handle which could be rotated manually.

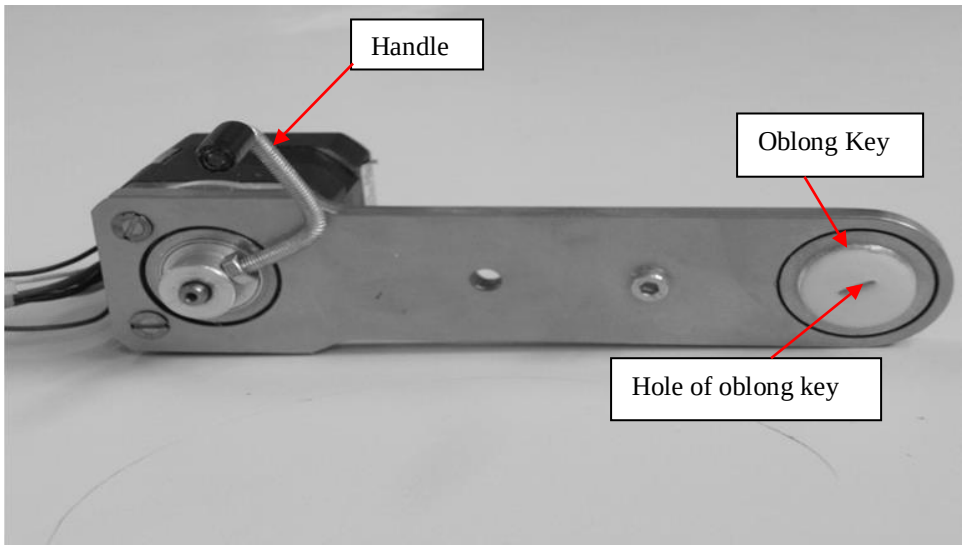

Fig. 1. 'False Twist Aggregate' device

Inside the device, there was a plastic belt which connected the handle with the key. As a result, with the rotation of handle, the key also rotated. Fiber strand of sliver passed through the hole of oblong key. When the handle rotated clockwise, the key also rotated clockwise and thus 'Z' twist was inserted. Similarly, when counter-clockwise, then 'S' twist was inserted on the fiber strand at the time of passing through the hole of key. However, this device was set up at the second pre-draft zone of the 4-over-4 drafting system.

Methods

The 'False Twist Aggregate' device was set up at the second pre-draft zone of the (4 – over – 4) drafting system of the ring frame. Because, if it was set up at the first pre-draft zone, then the fiber strand of the sliver that was just fed through the back rollers nip and that had not yet been drafted, would break during false twisting, as a result, it would not be possible to produce yarn in that case. However, when the handle was rotated completely one cycle manually, then one twist was finished. In this way, firstly one 'Z' twist in one second and just after that one 'S' twist in one second were inserted manually on the fiber strand. Then, one false twist in two seconds, one false twist in three seconds and one false twist in four seconds were inserted. Each time, 'S' twist was inserted just after 'Z' twist.

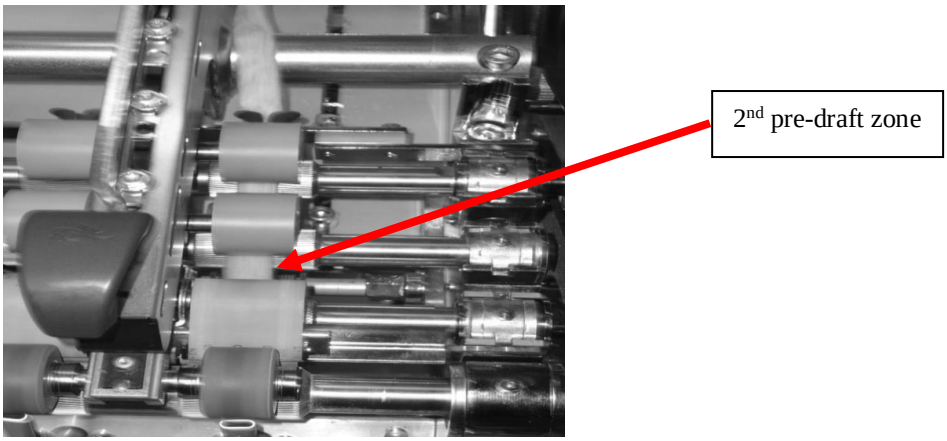

Fig. 2. Close view of 4-over-4 drafting system

Width of spinning triangle was measured using 'white marker' and 'slide caliper' during the production of each trial. After production, the tests of samples were carried out at standard testing conditions (BSI, 1963). Then CV% for yarn evenness was measured using 'Keisokki Evenness Tester 80' with testing speed of 200 m/min and tenacity of yarn was measured using yarn strength tester 'Textechno STATIMAT ME'.

Results and Discussion

Influence on width of spinning triangle

If the test results of width of spinning triangles for one false twist in different times are considered, then the following graph is obtained.

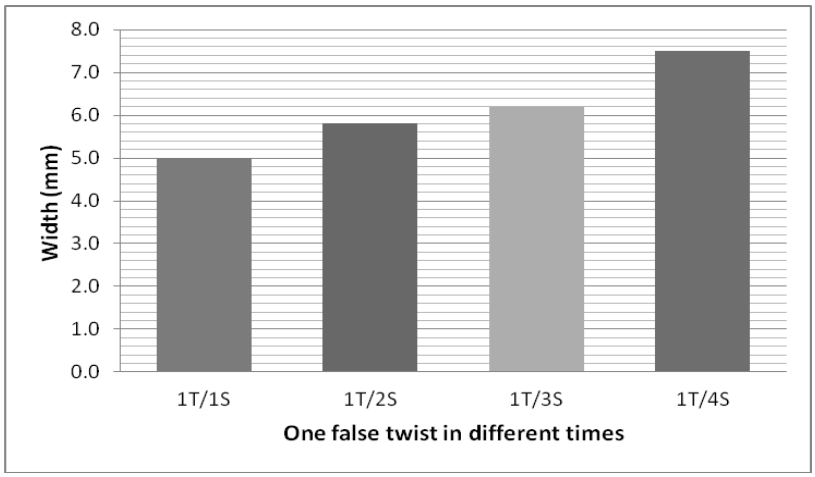

Fig. 3. Width of spinning triangle for one false twist in different times

From the above graph, it is very clear that width of spinning triangle is the lowest when one false twist in one second, but with the increase of time, width of triangle also increases. So, it can be said that width is minimum for one false twist at minimum time.

Influence on yarn evenness

If the test results for one false twist in different times in respect of CV% for yarn evenness are considered, then the following graph is obtained.

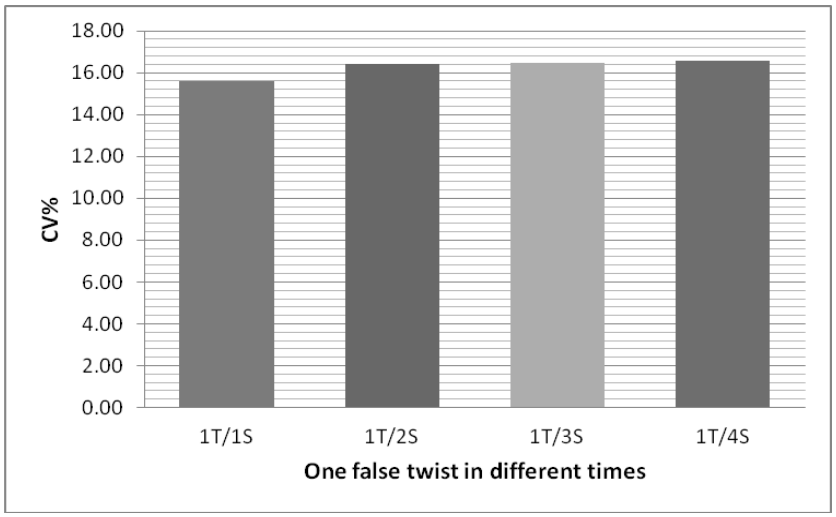

Fig. 4. CV% for yarn evenness when one false twist in different times

Here, the trend is same as the trend for width of spinning triangle. CV% is minimum when one false twist is inserted in one second, but with the increase of time, it also increases gradually. So, it can be said that it is possible to produce better quality yarn by inserting one false twist at less time.

Influence on yarn strength

If the test results of yarn strength for one false twist in different times are considered, then the graph is shown in Fig. 5.

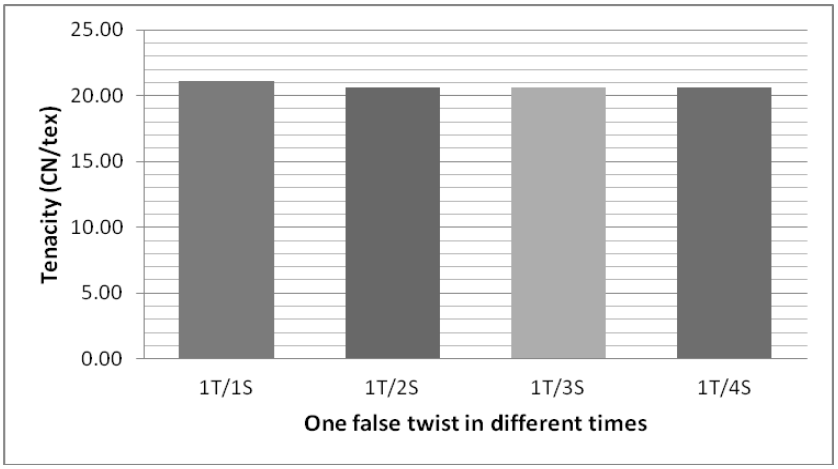

Fig. 5. Tenacity for one false twist in different times

Here, tenacity is maximum when one false twist is inserted in one second. But, with the increase of time, it decreases gradually. So, in this case, yarn of better strength is possible to prepare at the lower time. If time increases, yarn quality deteriorates.

However, from the all above three graphs and test results, It is clear that in all the cases, better quality yarn can be produced when one false twist is inserted in one second. The reason is that the false twist within the short duration of time has better influence on the fiber strand than within the longer duration of time at the second pre-draft zone of the (4 – over – 4) drafting system and this influences on the better compacting of fibers. As a result, fiber controlling is better in the front drafting zone which results good quality yarn.

Conclusion

In the experiment, effects of false twists on the fiber strand of sliver at the drafting zone of ring frame have been discussed and it has been observed that due to false twist with less or minimum time, there is better control of fiber strand in front drafting zone. This results good compacting of fibers and due to this reason, yarn quality is improved.

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