Short Communications

Effect of jerky movement of ring rail on quality of ring yarn

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A device has been designed to measure the jerkiness of ring rail of ring frame and the effect of ring rail jerky motion on the quality of yarn studied. The results show an increase in long thin faults in the yarn due to ring rail jerk.

Keywords: Classified faults, Cotton, Hairiness, Ring rail movement, Spinning tension

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The quality of ring yarn depends on the properties of raw material, and machine and process parameters. Though the contribution of raw material on yarn quality is major, the optimum machine and process conditions are essential to produce good quality yarn. The effects of break draft1-3, spacing between top and bottom aprons4-6, draft, drafting speed, compactness of material, spindle speed and other process parameters7-13 on yarn quality have been studied by many researchers. Poor maintenance of machine and house keeping disturb the smooth movement of ring rail, which is normally unnoticed unless the end breakage rate is higher. The jerky movement of the ring rail affects not only the end breakage rate but also the quality of yarn produced.

In this study, an instrument has been designed to trace the ring rail movement and to quantify ring rail jerk. The effect of ring rail jerk on the quality of yarn is also studied.

Figure 1 shows the instrument used for the measurement of ring rail jerk. The paper roll of width 10 cm is placed on a paper holder on one side of the instrument. The paper is guided through the rollers to a motor driven winding drum using the strings attached to them. A hard cardboard is placed between the guides, which acts as a platform for the paper and recording pen. The instrument is placed in such a manner that the pen, which is attached to the ring rail, is in contact with the paper while the ring rail moves up and down. When the motor is started, the winding drum rotates and causes linear movement of paper through the platform. When the ring rail moves up and down without jerk, the pen attached to it records the movement of the ring rail on the paper as shown in Fig. 2a. Figure 2b shows the recording of the jerk only during downward motion of ring rail.

The jerk was introduced to the movement of ring rail and recorded for 20 traverses. The starting and end points of each jerk are connected by a straight line and the area (a) enclosed by this straight line and the wavy curve is measured. The jerkiness per traverse (J) can be calculated as:

\[
\text{Ring rail jerk (J)} = \Sigma a
\]

![Fig. 1—Measurement of ring rail jerk](image1)

![Fig. 2—Ring rail movement (a) without jerk and (b) with jerk during downward motion](image2)
The average jerkiness \( (J) \) of 20 traverses was taken. The average number of jerks per ring rail traverse \( (n) \), i.e. traverse from top to bottom and bottom to top, is counted. The measure of \( 'n' \) is essential due to the reason that same Jerkiness value \( 'J' \) with different \( 'n' \) would result different effect on yarn quality. The jerkiness and number of jerks per traverse for different experimental arrangements are given in Table 1.

Combed cotton yarn of 7.4 tex (80 Ne C) was produced from 2.7 Ne roving with different experimental arrangements using a modern high speed ring frame having pneumatically loaded top arm with double apron drafting arrangement. The process parameters used for the production of yarn samples are given in Table 1. The properties of the raw material used for the production of yarn are: 2.5% span length, 31.1 mm; 50% span length, 15.65 mm; micronaire, 3.2; and bundle fibre strength, 20.7 g/tex.

The yarn samples were tested using a Premier IQ tester for unevenness %, imperfections and hairiness. The imperfections were measured at all the sensitivity levels, viz. thin: -30%, -40%, -50%, -60%; thick: +35%, +50%, +70%, +100%; and neps: +140%, +200%, +280%, +400%. The tests were carried out using the following specifications: test speed, 400 m/min; test time, 1 min; and No. of tests, 10 per sample. The single yarn tensile properties were measured using Premier Tensomaxx tester with gauge length of 500 mm, testing speed of 5000 mm/min and 100 tests per sample. The yarn faults were measured for samples S1, S3 and S4 using a Uster Classimat 3 (Model V2.10) tester.

Significance tests were conducted for tensile strength, elongation- at- break, hairiness index and imperfections of yarn. Multiple comparisons between the samples have been carried out at 5% significance level.

Figure 3 shows the imperfections of the yarn produced at different experimental arrangements and measured at different sensitivity levels. There is no significant change in imperfections of the yarn due to ring rail jerk. But Fig. 3 shows that there is marginal increase in thin places measured at the sensitivity levels -30%, -40% and -50%. Since the number of thin places measured at -60% are less, varying between 3 and 5, the trend is not followed. In the case of thick places the increasing trend is obtained only with +70%. Table 2 shows that there is significant increase in hairiness due to jerkiness of the ring rail

### Table 1—Process parameters used for the production of yarn samples

<table>
<thead>
<tr>
<th>Yarn sample No.</th>
<th>Yarn count (Ne)</th>
<th>Jerkiness ( (J) ) ( \text{mm}^2 )</th>
<th>Number of jerks ( (n) )</th>
<th>( J/n )</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>80</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>S2</td>
<td>80</td>
<td>28.60</td>
<td>28</td>
<td>1.021</td>
</tr>
<tr>
<td>S3</td>
<td>80</td>
<td>36.50</td>
<td>28</td>
<td>1.304</td>
</tr>
<tr>
<td>S4</td>
<td>80</td>
<td>37.04</td>
<td>15</td>
<td>2.469</td>
</tr>
</tbody>
</table>

### Table 2—Effect of ring rail jerk on tensile and hairiness properties of yarn

<table>
<thead>
<tr>
<th>Yarn sample No.</th>
<th>Hairiness index</th>
<th>Breaking tenacity</th>
<th>Breaking elongation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>g/tex CV%</td>
<td>%</td>
<td>CV%</td>
</tr>
<tr>
<td>S1</td>
<td>3.74 18.48 12.34</td>
<td>3.89 12.95</td>
<td></td>
</tr>
<tr>
<td>S2</td>
<td>3.92 18.0 13.86</td>
<td>3.92 15.42</td>
<td></td>
</tr>
<tr>
<td>S3</td>
<td>3.91 18.41 13.26</td>
<td>4.12 15.23</td>
<td></td>
</tr>
<tr>
<td>S4</td>
<td>3.95 17.97 14.16</td>
<td>4.01 15.93</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 3—Effect of ring rail on imperfections (a) higher sensitivity levels, (b) normal sensitivity levels and (c) low sensitivity levels (between samples S1 and S4). The ring rail jerk causes variation in the spinning tension and hence to the dimension of spinning triangle, which affects the integration of fibre in the yarn body.

Table 3 shows that the long thin faults \((H1+H2+I1+I2)\) increase due to ring rail jerk. The
The values of tensile properties are not affected significantly by the jerky movement of ring rail. But the variation in breaking strength and elongation-at-break is higher for the samples produced with ring rail jerk, which may be due to higher thin faults and weak places. The variation in tensile strength and elongation-at-break is higher in the case of sample 4 compared to sample 3 due to higher amount of jerk per ring rail jerk.

Due to the jerky movement of ring rail, the thin places in the yarn increase marginally; the hairiness of the yarn increases; classified yarn faults (long thin places) increase; and the mean value of tensile properties of the yarn is not affected, but the CV% of tensile strength and elongation-at-break increases.

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References