EFFECT OF YARN CHARACTERISTIC ON YARN TENSION DURING UNWINDING FROM PACKAGE

By: Shahin, A and Rakha, I

ABSTRACT - The object of this work was to study the influence of yarn surface finish on yarn tension during unwinding from package, the yarn tension was measured under the effect of different yarn characteristics such as:

- Doubled yarns
- Dyed yarns
- Mercerized yarns
- Bleached yarns
- Singed yarns
- Waxed yarns

It was found that the value of yarn tension related to the characteristics of the yarn surface, in order to ensure that these results are correct the coefficient of frictions for these different yarns were measured.

INTRODUCTION

In some textile processes the yarn should be used with a special characteristics such as dyed yarn, singed yarn, bleached yarn, mercerized yarn, doubled yarn.

By withdrawing these yarns from stationary packages at a constant speed the characteristic of yarn surface influences on the tension which varies the yarn tension. Hence, the variation in yarn tension of textile processes such as warping, weaving and knitting.
According to Ref. 11 the wet tension was measured on a sulzer weaving machine for a different wet yarn characteristics (waxed wet yarns and dyed wet yarns). It was found that the waxed wet yarn has a lower value of tension than the raw and dyed yarns.

According to the measurements stated in Ref. 13 many parameters affect on the coefficient of friction between yarn and guide, from among others, yarn twist, yarn speed, yarn tension, room temperature and relative humidity.

In Ref. 12 the relationship between wax weight per unit length of yarn and its coefficient of friction was recorded. Increasing the wax weight per unit length of yarn the coefficient of friction is decreased. However, if the wax weight becomes more than 0.7 gm per 10000 m yarn the coefficient of friction will not be changed.

In the present work an experimental study is carried out. During unwinding from stationary package at a high speed the effect of the following parameters on yarn tension are considered:

- yarn doubling
- yarn finishing (singed- mercerized- bleached- and dyed-yarns).

The coefficient of friction for all these yarns is also measured at different take up speeds (50, 150 and 250 m/min).

EXPERIMENTAL WORK

Figure (1) shows the arrangement of the apparatus which is used to measure the yarn tension during unwinding the yarn of a speed 900 m/min from a stationary package. The signal from the measuring head (Rotschild) was amplified using an amplifier. The electric signal was calibrated in force units [cN] and recorded on a chart. The mean value of yarn tension was plotted against package diameter for different yarn characteristics.

The electronic F-Meter from Rotschild was used to determine the coefficient of friction and its variability. Fig. (2) shows the arrangement of the apparatus which is used to measure the coefficient of friction between yarn and friction pin. The two signals from measuring heads (3), (5) were amplified through amplifiers (6), (7) respectively. The amplified signals were recorded on a calibrated pointer scales in force units (cN), and we can register the value of input and output yarn tension directly. The signals are fed also to an analogue computer to solve the equation of friction. After feeding the value of wrapping angle, the value for coefficient of friction can be recorded on a pointer scale in the apparatus.

Figs. (4, 6, 8 and 10) show the values for yarn coefficient of friction at different take-up speeds (50, 150 and 250 m/min)
Fig. 1: Measuring apparatus for yarn tension

1. package
2. guides
3. measuring head
4. amplifier
5. chart recorder
6. withdrawing drums

Fig. 2: Principle of Rotschild T-meter

1 - package
2 - brake for pre tension
3 - measuring head for input tension
4 - friction pin
5 - measuring head for output tension
6, 7 - amplifiers
8, 9 - pointer scales for input and output tension
10 - Analogue computer
11 - Pointer scale for coefficient of friction.
Specification of material used:

Table 1 shows the different types of cotton material (in form of conical packages) used and their characteristics.

<table>
<thead>
<tr>
<th>yarn count</th>
<th>yarn finishing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ne 8/1</strong></td>
<td>raw - carded</td>
</tr>
<tr>
<td><strong>Ne 16/2</strong></td>
<td>raw - roiled</td>
</tr>
<tr>
<td><strong>Ne 30/1</strong></td>
<td>raw - combed 17%</td>
</tr>
<tr>
<td><strong>Ne 100/2</strong></td>
<td>raw - combed 20%</td>
</tr>
<tr>
<td><strong>Ne 40/2</strong></td>
<td>raw</td>
</tr>
<tr>
<td><strong>Ne 40/3</strong></td>
<td>singed</td>
</tr>
<tr>
<td><strong>Ne 60/3</strong></td>
<td>singed-mercerized-dyed</td>
</tr>
<tr>
<td><strong>Ne 40/3</strong></td>
<td>singed-bleached-dyed</td>
</tr>
<tr>
<td><strong>Ne 40/3</strong></td>
<td>singed-mercerized-bleached</td>
</tr>
<tr>
<td><strong>Ne 40/3</strong></td>
<td>singed-mercerized-waxed</td>
</tr>
</tbody>
</table>

DISCUSSION

From our experiment we have found that, the double yarns have higher yarn tension than of the single yarns for the same linear density as shown in Fig. (3and5). The main reason for this difference comes from the change in friction between yarn and its guide during unwind from package. Measuring the coefficient of friction for these yarns, it was found that the double yarn has higher coefficient of friction than of the single yarns. This is due to the irregular circularity of yarn cross-section for double yarns, besides that the air resistance for double yarn through its flying in the rotating balloon is higher than the value of air resistance for single yarn, see Figs. (4 and 6).

Figure (7) shows the effect of yarn finishing on its tension. It was found that the raw yarn (Ne 40/2) has higher tension than of the singed yarn (Ne 40/2). This difference in yarn tension is due to the haziness of yarn. In order to ensure that these results are correct the coefficient of friction for these yarns were measured. It was found that the raw yarn has higher coefficient of friction than of the singed yarn, see Fig. (6). However the mercerized-dyed-yarn (Ne 60/3) has lower yarn tension and coefficient of friction than those of the raw yarn (Ne 40/2) and singed yarn (Ne 40/2). This is due to the improvements of the degree of smoothness for yarn surface through the mercerization process, see Fig. (7).

As shown in Fig. (9) the singed-mercerized-waxed-yarn and singed-mercerized-bleached-yarn have lower tension than the singed-bleached-dyed-yarn. This is due to the improvements of the degree of smoothness for yarn surface through the mercerizing and waxing process.

In case of singed-bleached-dyed-yarn (Ne 40/3-vat dyes) the yarn was scoured and bleached before dying process. These processes before dying leads to a damage in the surface of cotton fibre and lost its smoothness /5/. Measuring the coefficient of friction for these yarns, it was found that the dyed yarn has higher coefficient of friction than those of the other two yarns, see Fig. 10.
Fig. 3 package diameter versus yarn tension

Fig. 4: Yarn take up speed versus coefficient of friction
Fig. 5: Package diameter versus yarn tension

Fig. 6: Yarn take-up speed versus coefficient of friction
Fig. 7: Package diameter versus yarn tension

Fig. 8: Yarn take up speed versus coefficient of friction
Fig. 9: Package diameter versus yarn tension

Fig. 10: Yarn take up speed versus coefficient of friction
CONCLUSION

- The value of yarn tension increases with increasing the coefficient of friction. In general, the coefficient of friction is affected by the yarn characteristic.

- During the operation of multi weft yarn on the shuttleless looms it is better that their characteristics must be nearly the same, otherwise the efficiency of the weaving machine and fabric quality will be effected.

- In order to avoid the tension differences between yarns with different characteristics during the warping process, a self-balancing yarn brakes must be used. Then the loom efficiency and fabric quality will not be effected.

REFERENCES

/1/ Ltitz, Eigenheiten des Schussfadenabzuges Melland Textilberichte 10/1979 P. 345

/2/ Textil Praxis 2/1973 P. 77


/4/ ASTM, standard test method for coefficient of friction, yarn to metal D 3108-76