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Formation of Baked Yarn of Complex Structure, Methods for Determining The Hairiness of The Yarn and Hair Characteristics

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ABSTRACT: This paper examines the differences between the main purpose of the process of falling from individual fibers in a given linear density, density and elasticity and the methods of determining the hairiness of the yarn, the hairiness of the yarn is determined by the number of knots per unit length.

KEY WORDS: fiber, linear density, spinning, yarn, wrapping process, wicker, yarn fluff, electrostatic charge.

INTRODUCTION

The main purpose of spinning is to form a single flat yarn from scattered fibers with a uniform, defined linear density, continuous, pliable and elastic properties.

The essence of the processes performed on spinning machines is the thinning, baking and wrapping of the semi-finished product. The procedure and execution mechanisms of these three basic processes determine the specificity of the spinning methods. While all spinning methods are close in terms of the nature of the processes of thinning the semi-finished product to the level of the yarn and the resulting yarn wrapping, as well as the structure of the actuator, the method of yarn forming and baking has sharp differences. Therefore, all spinning methods are divided into spinning and non-spinning methods. In the wireless spinning method, the fibers that make up the yarn are attached using an adhesive mixture. Since this line belongs to a separate category of technological issues and is not used in the cotton industry, we will not dwell on their essence.. [1]

In spinning methods based on spinning, ie baking, the torque (force) on the moving fibrous product is affected. Such methods can be single or multi-zone, depending on the number of cooking zones and the order in which they are located.

Figure 1 illustrates the options for yarn formation by baking. In option I, the supply pair and the output pair are the boundaries of the cooking zone. Between them is a device that twists the fibrous product. If the supply and output pairs rotate in a stationary period, and the product in the intervals receives twists equal to the number of revolutions of the twisting device. In this case, the direction of the turns in both zones will be different. Such a twisting device is called a vyurok. [2]

THE MAIN RESULTS AND FINDINGS

If the baked product is released from the vortex, it will twist the fibers back under the influence of elastic forces. As long as the supply and discharge parts rotate continuously, the product passing through the rotating screw cannot twist. In other words, the product is not cooked. The above reviewed method is called the “fake cooking” method. Therefore, it is not possible to obtain a single layer of spun yarn in this method. The two-zone cooking method was used in spinning (PK-100) machines. Also, the multi-zone firing scheme was the basis for the production of yarn in the two-pronged firing method, and in this way, spinning machines were created. [3]

In the first scheme, it is necessary to wrap a part of it (vs) in a twisting device to form an irreversible loop. The winding body (tube) will need to be placed inside the twisting device to allow more twisting of the yarn while the supply speed is constant. As a result of such a change, the scheme shown in option II is formed. In the single-zone method in this scheme, real cooking is generated. Simultaneous baking and wrapping of the yarn in the wrapper located in the baking section is the only way to practice continuous and irreversible baking. However, in this method, spinning a yarn with a large mass at high speed requires a lot of energy.

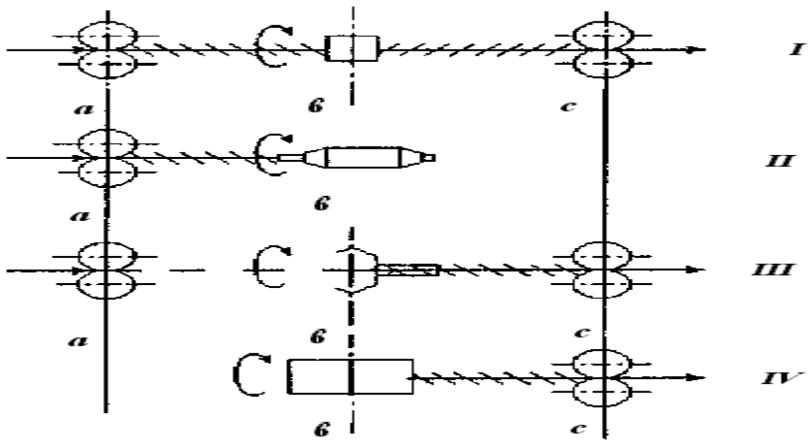

Figure 1. Threading methods

To eliminate such a defect, it is necessary to separate the cooking and wrapping processes. In order to separate, it is necessary to ensure that the piece of yarn coming to the cooking part does not accept and extend the torque. To do this, you need to temporarily break the integrity of the product coming into the cooker. Such a breakdown is accomplished by a break between the formations of the fibers of the fibrous product coming into the cooking device as a single stream. The fibers coming from the supply part move in a discrete state in zone *ав* , that is the coil cannot twist in this zone. The discrete fibers coming to the cooking device are added inside the device and condensed into a pellet. The rotation of the device cooks by twisting the product in the second *вс* zone. Hence, this method also performs single-zone cooking. Thus, single-zone cooking can be organized in the following cases:

- the fibrous product is baked in zone *ав* and the product-yarn in the second zone is wrapped in a tube in the baking device; in other words by adding together the cooking and wrapping processes.

- by limiting the twisting of the fibrous product in the first *ав* zone by violating its integrity, that is by separating the ripening process from the wrapping process.

Due to the fact that the tip of the baked product rotates freely in spinning according to variant III, this method is called "free-end spinning" or "rotor spinning" in foreign literature. [5]

Theoretically, if the winding formed by cutting or folding the fibrous product from the supply part in any way turns itself, it is baked in the output part (zone *вс*) and turned into yarn (variant IV). However, the resistance to deformation that occurs when wrapping or wrapping a thin fiber to the yarn level and then pulling it out of the wrapper is very low. As a result, there will be a lot of product breakdowns. Therefore, variant IV is not used for spinning from fibers. This single-zone baking is used in the chemical complex yarn baking industry. [6]

Many methods are used to determine the hairiness of the yarn. They differ from each other in some respects.

1. Gravimetric method.
2. Optical (projection) method.
3. Electrostatic method.
4. Photoelectric method.

In the gravimetric method, the degree of hairiness of the yarn is determined by the difference between the mass of the yarn and the mass of the hairless (burnt feathers) yarn. In this method you will get information about the mass of feathers, their number, the average length is not considered. Therefore, the accuracy of this method is low.

The essence of the optical (projection) method is that the number of hairs of a 1 mm long thread is counted by the image on the screen, ie projection, but when the number of hairs is large, it is difficult to count them separately. Later, this method was improved and the number of feathers, the degree of accuracy in more accurate calculation of their length was increased. In the study, it was proposed to determine the hair characteristics of the yarn by pre-prepared microphotography. The level of accuracy in this method is good, but it takes a lot of time and effort. [7]

The electrostatic method is a method of estimating the relative fineness of a yarn by means of an electrostatic charge.

Figure 2 shows a schematic diagram of the electrostatic method for determining the fineness of yarns. Equipment based on this method was developed at the Rouen Scientific Research Textile Institute in France. The wires 3 are charged in the electrostatic tube 2 in the area caused by the high voltage generated by the generator 1, and the hairs become perpendicular to it. In this case, the feathers are separated and flattened. As the wires pass through tube (4), the charges at the ends of the feathers separate and collect at capacitor (6). The charge on the capacitor is measured using a galvanometer (5).

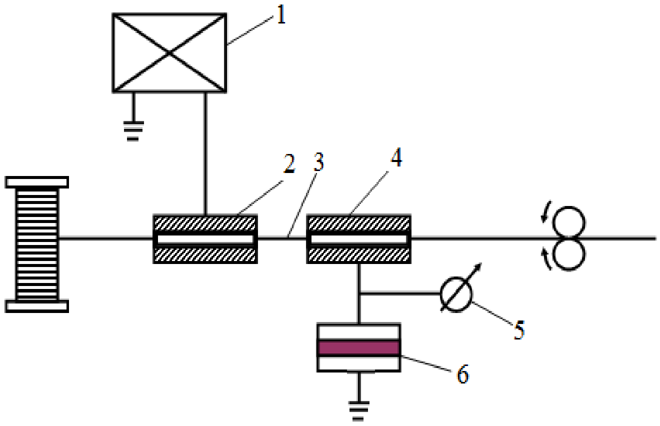

Figure 2. Schematic diagram of the electrostatic method for determining the fineness of yarns

The disadvantage of this method is that the indicators depend not only on the charge, but also on the moisture, electrical conductivity of the yarn, which makes it difficult to accurately assess the hair. It is not possible to determine the length of the feathers by this method.

The photoelectric method (using optical magnification) allows you to automatically count the number of hairs corresponding to the length of the yarn being continuously inspected. Photoelectric methods are widely used. [8]

One of the most widely used photovoltaic devices used to determine the degree of hair loss is the device of the British firm "Shirley". This device determines the total number of hairs in a 1 m thread with a length greater than 3 mm, as well as the number of hairs from 0 to 10 mm in length in a 1 mm step interval corresponding to 1 m of thread. [9]

The following are used as indicators of the hairiness of a rope: the number of feathers per unit length (usually 1 m) - $n_в$; average length of feathers-l, mm; total surface of hairs - $S_в$, mm.

The number of hairs per unit length is $n_в$ – a commonly used indicator, which indicates that the hairs are densely packed.

Numerous scientific studies have confirmed that the distribution of the number of hairs along the length of a thread obeys Poisson's law. According to this division, the probability of hair formation can be expressed as follows:

$$P_K = (a^к exp - a) / k!,$$

Here $a -$ is the probability of hair formation per unit length (1 cm).

Given that all the fibers that make up a thread can have a free end, the number of ends of all the fibers that come out of the surface of the thread and form a hair in 1 meter.

$$n_в = 2 \cdot 10^3 T_{un} / (T_в \ell_в),$$

Here $T_{un} -$ average linear density of yarn, tex; $T_в -$ average linear density of fibers, tex; $\ell_в -$ average length of fibers.

The formula proposed by A.Baralli to calculate the number of hairs per 1 mm of thread length looks like this:

$$n = 1{,}57\frac{d_в(d_{un} - d_в)}{L_в \cdot k},$$

Here $d_в, d_{un} -$ average diameter of fiber and thread, mm; $L_в -$ average length of fibers, mm; $k -$ correction depending on the cooking coefficient $(k = 0{,}66\ldots0{,}004\alpha)$.

The obtained results in these formulas are approximate. The average length of hair depends on many factors and varies significantly. In particular, according to T.N. Borovikova, L = 1.07... 1.6 mm for cotton yarn, L = 1.35... 1.7 mm for wool yarn. [10]

CONCLUSION

The sum of the lengths of the hairs is an integral estimate that takes into account the number of hairs corresponding to the length and their average length. This is why many researchers have been using this characteristic. It is calculated as follows:

$$L_в = \ n \cdot l$$

The sum of the total feather surface is also an integral characteristic. It can also be used to compare the number of hairs, the cross-sectional area of the fiber, with other yarns that differ in length, taking into account the number of hairs, their average length, and their average cross-sectional area.

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