A METHOD OF DECREASING THE UNEVENNESS OF BRAIDING OBTAINED IN THE PROCESS OF BRAIDING

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Abstract: *In this article, there has been developed a mathematical model to determine the amplitude-frequency characteristics of braiding unevenness produced on the HSR-1000 braiding machine, taking into account the variation of the braiding unevenness from 6.5% to 3.7%. Based on conducted research, there was recommended a method of reducing the product unevenness indicator by selecting the supply scheme of the braiding machine. From the comparative analysis of results of the theoretical and experimental research, it was found that the unevenness indicators of obtained braidings were found to be within the limits of the allowed values.*
Keywords: *displacement equal to the path of the product to attachment point, minimum distance from the center of formation to process of densification in funnel, relative breaking strength, elongation at break, hygroscopicity*

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Introduction.Globally, fibers obtained from waste and secondary material resources from the sewing process make up 25% of all textile raw materials. This is a huge stock that can be used for production. However, only 10% of these scraps are used. Basically, they are processed into materials that cannot be used for various purposes, or they are made into simpler, lower-cost ropes, furniture and technical fabrics, for wiping and other purposes.

In carrying out the research work, a braiding has been obtained from mixture of secondary fibers of 10% nitron, 60% cotton and 30% from JV LLC "SAFIRA-SAMIRA TEXTILE" in Bukhara region, "EURASIYA ALLIANCE TEX" LLC and "CHACH TEX" LLC and "EURASIYA ALLIANCE TEX" LLC in Chirchik district of Tashkent region. In the laboratory of the "Spinning Technology" chair of TITLI, the obtained braidings are combined into braidings made of 100% cotton fiber on the HSR-1000 type braiding machine according to a scheme below, and braidings from a mixture of cotton fiber 66.4% + secondary fiber 28.8% nitron fiber - 4.8% there was obtained in 3 different options (Fig. 1).

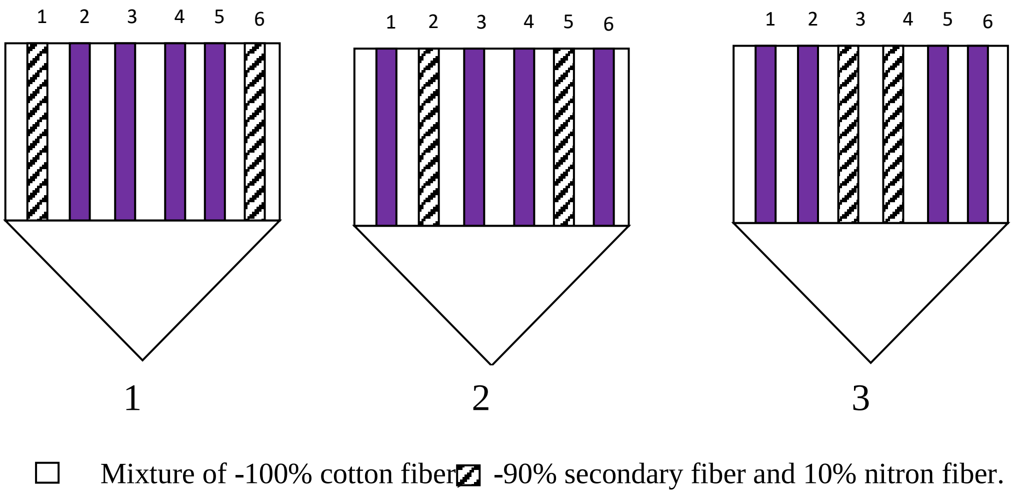

Fig.1. Braiding placement scheme in braiding machine HSR-1000.

Quality indicators of braiding and cotton, nitron and secondary fibers in the composition of the yarn are given in the tables 1 and 2.

Table 1

Quality indicators of the secondary fibers

#	Linear density of the fiber, mteks	Breaking force, sN	Comparative breaking force , sN/teks	Staple mass length, mm	Short fibers,%
1.	171	3,7	21,6	23,5	25,4

Table 2

Quality indicators of the cotton fibers

#	Типи	Linear density of the fiber, mteks	Breaking force, sN	Comparative breaking force , sN/teks	Tension in breaking, %	Upper average length, mm	Length similary index, %
1.	V	183	5,38	29,42	10,65	27,41	85,60

Nitron fiber is softer and more flexible than caprone and lavsan. In terms of abrasion resistance, nitron is inferior even to cotton. Toughness of nitron at break is two times smaller than that of caprone and lavsan, relative breaking strength is 30-35 sN/tex, elongation at break is 16-22%, hygroscopicity is very low - 1.5%.

Materials and Methods. The braiding process is widely used in spinning technology. A purpose of addition is to equalize structure and mass of the product. If linear density of collected products is characterized by random functions, then the probability characteristics of the resulting product can be determined by formulas. In practice, it is often the case that products to be combined have a periodic component of suitable phase, in which case Fourier series coefficient for component is the same for any product being combined. Straightening efficiency can be achieved even if stretching tool associated with the previous machine is combined with the product coming from different paths to exit point of the stretching tool in different ways. In this case, the process uniting *n* products can be interpellated as a signal passing through the system $e^{s\tau}$ of elements inserted in parallel from the transfer function. where - τ is equal to the magnitude of the shift, which is equal to path of the product to point of attachment.

If a non-uniform shift is acceptable, the harmonic numbers can be reduced. If *n* is an even number, then the *n/2* products must be combined so that they reduce to the first harmonic, and the two products reduce to the second harmonic after the second combination. Short wavelengths and large amounts of additives clearly limit the efficiency of alignment in splicing, through which optimum displacement of splicing products can be achieved.

Results and Discussion. Sometimes the products to be folded are out of phase, for example, braids can be obtained from fibers of different staple lengths. A mixture of 90% secondary material resources and 10% nitron fiber was obtained in a 6000 tex braid formation on a braiding machine.

A lot of research work has been carried out on reduction of product unevenness in the process of braid formation.

For the approximate solution of equation describing the process of forming a braid from a product with different input parameters, we assume the following. Speed of desired product elements is constant during the formation process.

In Figure 2, we present X, Y rectangular coordinate system.

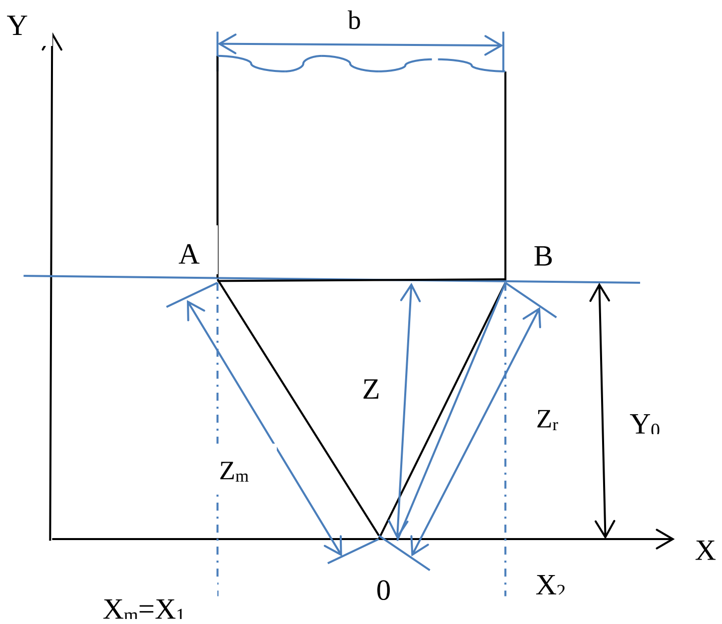

Fig.2. Scheme for braid formation in the braiding machine.

Abscissa axis of X is parallel to the stretching tool, and is the point of clamping the bolt. Initial product width *b*. Let's think of the dU as sum of an infinite number of equal-width braids. If the parameters of initial product change according to the law $y_1(x)\frac{dU}{b}$. In the braiding formed as a result of the formation process, the currents move relative to each other by a value equal to the difference in the distances traveled by the currents during the formation process.

The displacement determined in this way is equal to ε

$$\varepsilon = z - z_m \quad \text{or} \quad \varepsilon = \sqrt{X^2 + Y_m^2} - \sqrt{X_m^2 + Y_0^2} \qquad (1)$$

Here - z is crossing distance of the braiding in the process of formation; z_m- minimum distance from the center of formation to the funnel to the densification process; Y_0- distance from the center of the funnels to the clamp line; X_m-AB intersection point coordinate.

After the formation process, the change of the parameter along the flow is equal to $y_2(x)dX$:

$$y_2(x)dX = y_1(x-\varepsilon)\frac{dX}{b} \qquad (2)$$

Obviously, is equal to $\varepsilon \geq 0$.

Output is the total sum of the fibers coming out of the stretching tool. Therefore, change in parameters of the output product $y_2(x)$ is determined as follows.

$$y_2(x) = \frac{1}{b}\int_{x_1}^{x_2} y(x-e)dX \qquad (3)$$

Here x_1, x_2 - coordinate points A and B on the clamp line.

Based on Laplace's theory of integration with respect to images and theorems on the displacement of the region of the originals, we find the transfer function of the generation process:

$$W(s) = \frac{1}{b}\int_{x_1}^{x_2} e^{-s\varepsilon}dX \qquad (4)$$

$W(s)$ we proceed to the calculation of the function. If we put the value ε to formula (1) we will obtain an expression (3.4);

$$W(s) = e^{s}\sqrt{X_m^1 + Y_0^2}\,\frac{1}{b}\int_{x_1}^{x_2} e^{-s\sqrt{X^2+Y_0^2}}dX \qquad (5)$$

$Z = \sqrt{X^2 + Y_0^2}$ gives the change.

$$W(s) = \frac{e^{sz_m}}{b}\int_{z_1}^{z_2} F(z)e^{-sz}dz \qquad (6)$$

This formula is true when the X AB cross-section has the same sign if the former has shifted to the longitudinal axis of the product entering the center of the funnel by a distance equal to or greater than half of the product width.

Therefore, $X_m = X_1$ is equal to $z_m = z_1$.

Otherwise $(X_1 < X_m < X_2)$

$$W_{(s)} = \frac{e^{sz_m}}{b}\left[\int_{z_m}^{z_1} F(z)e^{-sz}dz + \int_{z_m}^{z_2} F(z)e^{-sz}dz\right] \qquad (7)$$

Integrals in the last two equations are not expressed by elementary functions.

Let's study the function under the integral

$$F(z) = \frac{z}{\sqrt{z^2 - V_0^2}} \qquad (8)$$

When we divide the X_1; X_2 sections into k sections, we will calculate the constant $F(z)$ and $F(z_0)$ equality for each of t hem. Here z_0 - the distance from the funnel to the center of the section. We define the distance from the funnel to the beginning of the section as z_1.

Then $$I = \frac{1}{b}\int_{z_1}^{z_2} F(z)e^{-sz}dz \approx \frac{1}{b}\sum_{i=1}^{k} I_i \qquad (9)$$

Here $$I_i = F(z_{\upsilon i})\frac{e^{-sz_i} - e^{-sz_{i+1}}}{s} \qquad (10)$$

After solving the joint equations (6), (9) and (10), we obtain the approximate transfer function $W^*(s)$ in the formation process

$$W^*(s) = \frac{e^{sz_1}}{b}\sum_{i=1}^{k} F(z_{\upsilon i})\frac{e^{-sz_i} - e^{-sz_{i+1}}}{s} \qquad (11)$$

High accuracy results can be obtained by linear interpolation.

Let us replace the function in each interval $i - м$ with linear function $\overline{F}(z)$ corresponding to $F(z)$, then we consider the corresponding polynomial $F(z)$:

$$F_i(z) - C_i z + d_i$$

Section of C_i and d_i coefficients are found from the condition of equality of the estimated and real functions at the end of the section.

$$C_i = \frac{F(z_{i+1}) - F(z_i)}{z_{i+1} - z_i}$$

$$d_i = F(z_i) - C_i z_i \qquad (12)$$

Then $$I_i = \int_{z_i}^{z_{i+1}} (C_i z + d_i)e^{-sz}dz = \frac{C_i}{s^2}\left[e^{-sz_i}(sz_i + 1) - e^{-sz_{i+1}}(sz_{i+1} + 1)\right] + \frac{d_i}{s}(e^{-sz_i} - e^{-sz_{i+1}}) \qquad (13)$$

Equations (7), (9) and (13) yield the following equation

$$W^*(s)_{1,2} = \frac{e^{sz_1}}{b}\sum_{i=1}^{k} I_i \qquad (14)$$

(Formula (14) is used to determine a shape of the amount of braiding in the braiding joining machine.

In short, we determine the amplitude characteristics of the braid formation process by the ratio of the amplitude fluctuations of the braid parameters to the amplitude of the initial product of 4 long fibers and 2 short fibers (bundling of the braid in the current.

Amplitude characteristic can be determined by a certain relationship:

$$A_i(\omega) = \sqrt{W^*{}_{(s)_1} \cdot W^*{}_{(s)_2}} \qquad (15)$$

Here $W^*(s)_1$ - is characteristic that determines the unevenness of the cotton fiber braiding; $W^*(s)_2$ - characteristic that determines the unevenness of the braid obtained from secondary fibers.

Thus, approximate formation processes are accepted for any character of changes in considered parameter of the initial product-braiding.

(15) the previous determination of the transfer function of the process of adding the formula allows to find the amplitude characteristic of this process.

It is known that parallelization of fibers and correction of linear density of braids is carried out in the process of stretching, using a braiding machine, joining and automatic adjustment of manufactured product. A process of stretching, combining and adjusting linear density will depend on unevenness of the film. Sequential implementation of these processes leads to a change in the unevenness indicator of manufactured product, as a result, spin yarn will have uneven indicators in terms of linear density.

In conclusion, there has been developed a mathematical model to determine the amplitude-frequency characteristics of braiding unevenness produced by the braiding machine, taking into account that the unevenness of combined braiding varying from 6.5% to 3.7%. Based on conducted research, there was recommended a method of reducing the product unevenness indicator by selecting supply scheme of braiding machine.

From the comparative analysis of the results of the theoretical and experimental research, it was found that the unevenness indicators of the obtained braids were found to be within the limits of the allowed values.

Conclusion. It was possible to implement the basic principles of product-pill unevenness correction, and it was tested theoretically and practically. As a result of the application of this method in the pelting machine, the consumption of raw materials was reduced, and pelts of high quality were produced.

Recommended method makes it possible to smooth out the unevenness of the braiding and to reduce the deviation limit by a certain amount.

Reference:

1. Azizov I.R., Jumaniyazov Q., Erkinov Z.E. Waste-free fiber processing technology. "Innovative Development Publishing House". Tashkent, 2020. Pg.316.

2. http://legport.ru/articles/24883.

3. http://www.equipnet.ru/equip/equip_33552.html.

4. Möglichkeiten zur besseren Rohstoffnutzung durch Aufbereitung ung Beimischung von gerissenen Carnresten in der Spinneret "Textil Praxis international", 1987, 42. №4. - S. 363-366.

5. Lyszczer J., Piatek F. Streichgarnherstellung direktvon Krempelbanden. "Internationales Textil Bulletin Carnherstellung", 1986, 32. №1. - S. 73-75.

6. Kazakova, D.E., Zhumaniyazov, K.Z., Ochilov, T.A., ...Plekhanov, A.F., Koroleva, N.A. Influence of different mixture structure on mechanical damage and fiber length on transitions of spinal processes. Izvestiya Vysshikh Uchebnykh Zavedenii, Seriya Teknologiya Tekstil'noi Promyshlennosti - this link is disabled, 2019, 384(6), p. 129–132

7. Kazakova, D.E., Zhumaniyazov, K.Z., Ochilov, T.A., ...Plekhanov, A.F., Koroleva, N.A. Influence of different mixture structure on mechanical damage and fiber length on transitions of spinal processes. Izvestiya Vysshikh Uchebnykh Zavedenii, Seriya Teknologiya Tekstil'noi Promyshlennosti - this link is disabled, 2020, 389(5), p. 115–118.

8. Korabayev Sherzod Ahmadjonovich Valieva Zulfiya Fakhritdinovna, Akhmedov Akmal Axmedovich, Ochilov Tulkin Ashurovich, Ubaydullayeva Dilora Xamidovna 2021/5 Annals of R.S.C.B.

9. Ochilov Tulkin Ashurovich, Ashurov Khasan To'lqin ugli, Kulmetov Mirpolat, Usmonova Shakhnoza Anvarovna, Mirzaakhmedova Khuriyat Basitovna, Korabayev Sherzod Ahmadjanovich. Evaluation of Physical and Mechanical Properties of Fabric Fabrics from Different Secondary Material Resources. Design Engineering. Issue: 3 | Pages: 101-110.

10. Ochilov Tulkin Ashurovich, Khalmatov Davronbek Abdalimovich, Shumqorova Shamsiya Pulatovna, Usanov Mustafaqul Makhmud ugli, Korabayev Sherzod Ahmadjanovich. Analysis of Quality Indicators of Mixed Spun Wool Yarns. Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 779 – 786.

11.Aralbaevich, P. B., Abdumalik, P., Faridovich, R. F., & Zivaddinovich, M. S. (2022). Changes of cotton fiber properties in the ginning and automatic bale opener. *European Chemical Bulletin*, *11*(1), 4-4.

12. Paluanov, B. A., & Pirmatov, A. P. (2021). Organization of compact spinning technology in textile clusters. *Karakalpak Scientific Journal*, *4*(1), 17-22.

13.Baxtiyar, P., & Abdimalik, P. (2021). Efficient organization of harvesting and processing of cotton seeds. *Universum: технические науки*, (3-4 (84)), 77-79.

14. Baxtiyar Paluanov, Abdumalik Pirmatov, Jurabek Muxtarov, Batir Kojametov. Investigation of mechanical damage of cotton fiber in the process of pressing and baling. Universum: texnicheskiye nauki № 3 (96) 2022. DOI - 10.32743/UniTech.2022.96.3.13229