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RESEARCH ON REDUCING THE PILE OF YARN ON A RING-SPINNING MACHINE

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Abstract
Yarn piling on ring spinning machines is a persistent issue affecting the quality of yarn and the efficiency of textile production. This study investigates methods to reduce yarn piling by optimizing spinning parameters, including spindle speed, twist multiplier, and fibre properties. Experimental trials were conducted using varying conditions to assess their impact on pile formation and yarn quality. The results indicate that reducing spindle speed and adjusting the twist multiplier significantly decreased yarn piling while maintaining tensile strength. These findings offer practical guidelines for manufacturers to enhance productivity and product quality, reducing operational costs and waste in textile production.

Keywords: Ring spinning machine, yarn piling, textile production, twist multiplier, spindle speed, fibre properties, yarn quality improvement, textile manufacturing efficiency.

Introduction

In our republic, large-scale measures are being taken to develop the textile and light industry, and to introduce new innovative technologies into the industry, to produce new types of competitive, resource-saving and exportable light industry products. The development strategy of New Uzbekistan for 2022-2026 [1], includes "Continuing the industrial policy aimed at ensuring the stability of the national economy and increasing the share of industry in the gross domestic product, increasing the production volume of industrial products by 1.4 times, doubling the production volume of textile industry products, studying the impact of the textile industry on all production processes while joining the World Trade Organization, fully processing cotton yarn by 2026 the tasks of establishing, creating and developing national brands for finished products, increasing their export potential [2]. In the implementation of these tasks, in particular, by improving the quality of the yarns spun by the ring method, by

improving the construction of the machine These scientific researches aimed at reducing thread unevenness, increasing breaking strength, and reducing hairiness indicators are important.

Materials and Methods

In a ring-spinning machine, fibre flow control elements play an important role in a variety of applications, such as fibre-reinforced yarn production, textile production, and fibre optic systems. The parameters governing the behaviour and performance of these elements are complex and involve interactions at the microstructural and macroscopic levels. Understanding these parameters is critical to optimizing the design and functionality of fibre flow controls. It provides a comprehensive theoretical analysis of key parameters related to fibre flow control, based on insights from various studies.

The drawing pairs of the ring spinning machine now consist of three cylinders and three rollers, and in order to improve the quality parameters of the spun yarns obtained in the spinning mills, changing the rifling grooves of the cylinder producing the drawing pairs to an angle of 80, the spun yarn theoretical analysis of quality indicators. In the ring-spinning machine, the incoming pile is first passed through the guide and enters between the stretching pairs and is thinned and parallelized to the desired linear density. It is known that fibre deviation from the cylinder leads to an increase in the quality indicators of spun yarns, i.e. hairiness. To produce a yarn with uniform and defined properties, the fibres being added must have the same tension (have the same pitch as they are placed along the screw line) and have the same distance to each other. They should be taken. In the case of different tension, the fibre with lower tension wraps around the fibre with higher tension, which leads to one of the yarn defects, which is the formation of hair on the yarn.

When the fibres deviate from the centre, some fibres become the core, and some become brittle and stick out on the fibre. This leads to an increase in the hairiness of the resulting spun yarns. So that it's hair formation to prevent this, the fibres were directed to the centre by turning the rifle grooves of the cylinder to a rational angle.

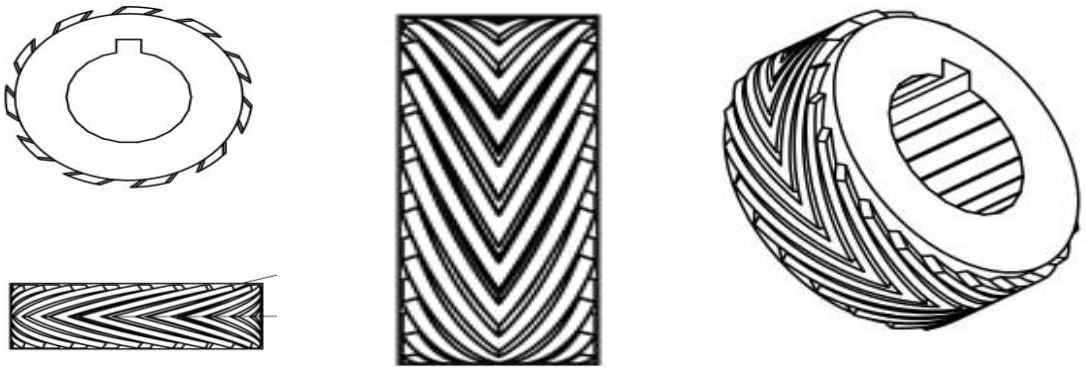

Figure 1. Geometric scheme of the recommended exhaust cylinder

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Table 1. Physico-mechanical parameters of spun yarn with a linear density of 20 tex

Quality indicators	The speed of the car	Exhaust cylinder bore graduations	Coefficient of variation by thread number [U%]	Coefficient of variation of thread unevenness, CV 1m %	Thin parts of the thread, Thin -40 % /km	Thick areas of thread, Thin 50 % /km	Knots of thread Knot, 200% ta/km	Fertility level, H	Relative tensile strength sN/tex	Elongation at the break by force applied to the specimen
Quality indicators of spun yarn produced at the enterprise	15000 rpm	-	10.65	4.59	60	60	138	6.20	15.8	5.29
	16000 rpm	-	10,12	4.02	43	76	156	6.41	15.2	4.88
	17000 rpm	-	10.60	4.11	45	85	185	6.85	14.9	4.85
Of the issuing cylinder quality indicators of spun yarns obtained by changing their grooves	15000 rpm	80	10,19	4.26	47	38	120	6.28	15.9	5.93
	16000 rpm	80	10.74	4.09	95	75	108	6.14	15.9	6
	17000 rpm	80	10.75	3.89	90	90	133	6.13	15.5	5.8
Uster statistics 2023	5%	-	-	3.43	59	50	118	4.6	18.78	6.39
	25%	-	-	3.91	97	85	188	5.0		5.77
	50%	-	-	4.35	180	135	303	5.5	15.82	5.29
	75%	-	-	4.98	311	253	482	6.2		4.89
	95%	-	-	5.6	564	426	719	6.7	13.84	4.48
UzDSt-3312-2018	1st class	-	-	-	-	-	-	-	20.9	6.9
	2nd class	-	-	-	-	-	-	-	18.8	6.5
	3rd class	-	-	-	-	-	-	-	16.8	6.2
	4th grade	-	-	-	-	-	-	-	15.7	5.8

In an industrial ring spinning system, all fibres entering the zone of stretching pairs are parallel to the axis of the spun yarn being spun. In this new system, the width of the yarn starts to gradually decrease as the tension of the front rollers decreases, thus creating a reduction in the twisted triangle.

Results and Discussion

In our research work, we compared the physical and mechanical properties of the spun yarn obtained by the enterprise method and the spun yarn obtained by changing the grooves of the

output cylinders of the ring spinning machine with each other, based on the analysis of the spinning laboratory equipment manufactured by the Swiss company Uster determination was achieved.

How clear, smooth and uniform the colour of clothes is depends on the degree of hairiness of the threads in the fabric. The fewer the defects on the surface of the spun yarn, the higher the quality of the yarns obtained from them. Knots on the surface of spun yarn and fabrics are called "Knots" (neps).

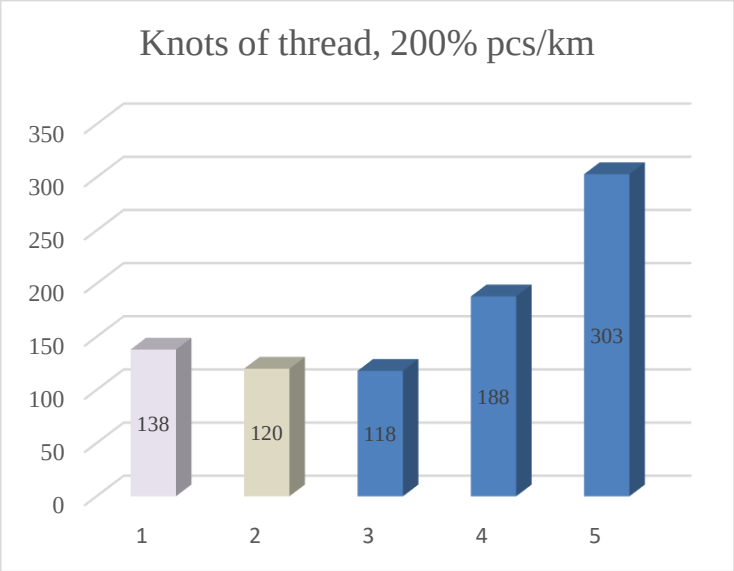

Figure 2. Indicators of knots (neps) of threads:

1 Machine speed at the factory is 15000 rpm 2. The variation coefficient of thread unevenness was obtained by changing the grooves of the cylinder to 80 for the machine speed of 15000 rpm 3. Uster statistician 2023 5% indicator 4. Uster 2023 is a statistic of 25%. 5. Uster statistics 2023 with 50% indicator.

In the conducted studies, the number of knots (neps) of the spun yarn in the enterprise was 138 units/km on average, when the surface defects of the yarn were checked on the Uster Tester 6 device, the speed of the ring spinning machine was 15,000 rpm, and it was obtained by changing the grooves of the release cylinder and the number of defects of the spun yarn is 80 to 120 pieces/km, the ring spinning machine compared the results obtained at the speed of 15000 rpm with the indicators of Uster statistics 2023, it was found that the spun yarns obtained by changing the angle degrees of the spinning cylinder produced by the enterprise to 80 fell to the indicator of uster statistics by 25%.

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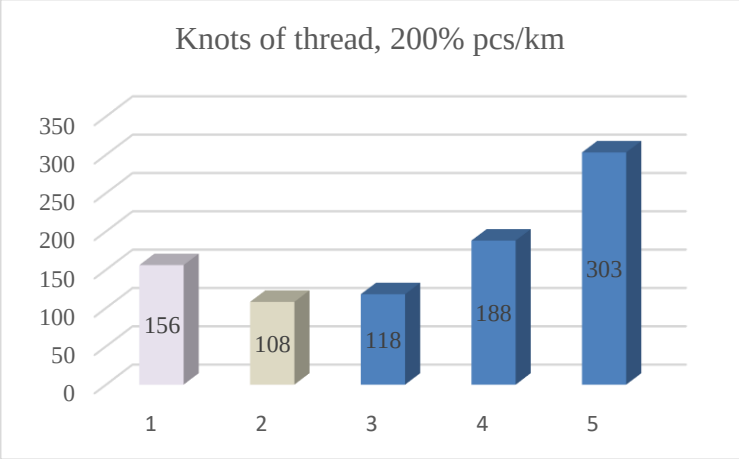

Figure 3. Indicators of knots (neps) of threads:

1. Machine speed at the factory is 16000 rpm 2. Coefficient of variation of thread roughness obtained by changing the grooves of the cylinder to 80 for machine speed 16000 rpm 3. 5% indicator of Uster statistic 2023 4. Uster Statistic 2023 25% Indicator 5. Uster Statistic 2023 is a 50% indicator.

It was found that the number of knots (neps) of the spun yarn obtained at the speed of the ring spinning machine at the enterprise is 156 units/km.

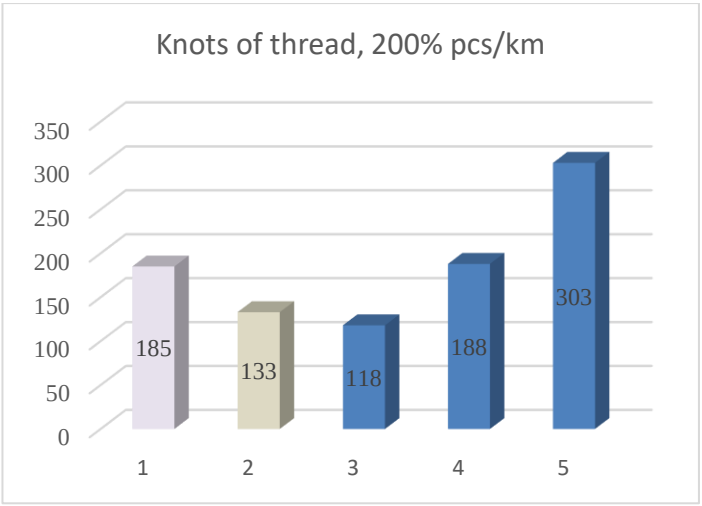

Figure 4. Indicators of knots (neps) of threads:

1. Machine speed at the factory is 17000 rpm 2. Coefficient of variation of thread unevenness obtained by changing the grooves of the cylinder to 80 for machine speed 17000 rpm 3. 5% indicator of Uster statistic 2023 4. Uster statistics 2023 indicator of 25%. 5. Uster statistics 2023 with 50% indicator.

The speed of the ring spinning machine was 17,000 rpm, the knot index of the spun yarns produced at the enterprise was 185 units/km, and the knot index of the spun yarns obtained by changing the angle of the rifling grooves of the output cylinder by 80 degrees was 133 units/km. Based on the results of the research, it can be concluded that the machine spun when the speed is changed does not significantly affect the knot performance of yarns.

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Also, the hairiness of the thread is an important factor in fabric production. Depending on what kind of product is produced, the degree of hairiness of the thread is selected. For example, hairy yarns are mainly used in weaving cotton, flannel and other soft and warm fabrics. The degree of hairiness is the number of hairs that make up the fibres of the spun yarn, one end of which is in the yarn and the other end is located outside the spun yarn. In the research, we can see that the hairiness level of the spun yarns was obtained by changing the grooves of the spinning machine's output cylinder when the results were obtained by checking the hairiness level of the spun yarn in the laboratory equipment.

Spinning consists of a complex of continuous technological processes, which have a large number of interrelated and conditional factors, and uncontrolled external and internal changes that directly affect the quality of processed products. As a result of individual or combined effects of these factors, disruptions in the stability of the technological process occur, leading to sharp changes in the quality indicators of rough and finished products, that is, to the appearance of unevenness.

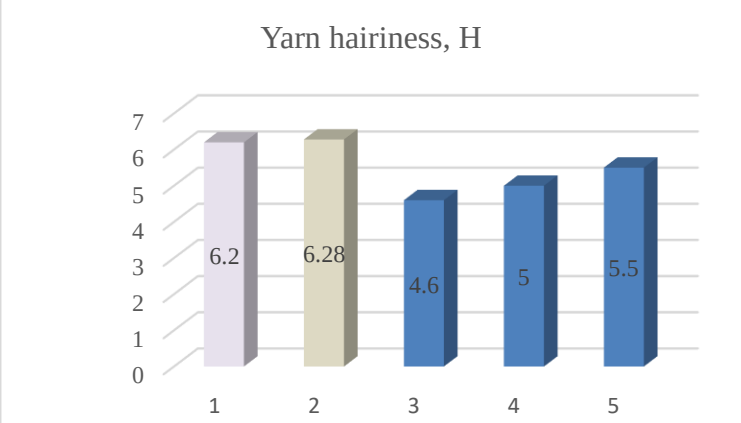

Figure 5. Hairiness indicators of threads:

1 Machine speed at the factory is 15000 rpm 2. The variation coefficient of thread unevenness was obtained by changing the grooves of the cylinder to 80 for the machine speed of 15000 rpm 3. Uster statistician 2023 5% indicator 4. Uster 2023 is a statistic of 25%. 5. Uster statistics 2023 with 50% indicator

During the research, the hairiness indicators of the spun yarns obtained on the ring spinning machine were compared with the Uster Statistics 2023 indicators, and the results obtained by changing the rifle grooves of the output cylinder were compared with the indicators of the enterprise and Uster Statistics. If the speed of the ring spinning machine is 15,000 rpm, the hairiness level of the spun yarns produced at the enterprise is 6.2 H, while the hairiness index of the spun yarn obtained without changing the speed and changing the rifle slots to 80 is 6.28 H. from the above indicators of hairiness, it is known that the spun yarn produced at the enterprise yarn Uster statistics 2023 is down to 75%. In the course of research, it was found that our spun yarn obtained by changing the angle degrees of the spinning cylinder to 80 is very close to 50% of the statistics.

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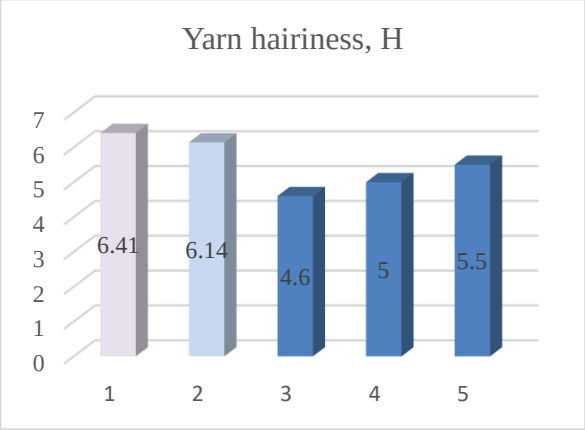

Figure 6. Hairiness indicators of threads:

1. Machine speed at the factory is 16000 rpm 2. Coefficient of variation of thread roughness obtained by changing the grooves of the cylinder to 80 for machine speed 16000 rpm 3. 5% indicator of Uster statistic 2023 4. Uster Statistic 2023 25% Indicator 5. Uster Statistic 2023 is a 50% indicator

It is known that the hairiness level of the spun yarns produced at the speed of the ring spinning machine at 16000 rpm is 6.41 H. It's done.

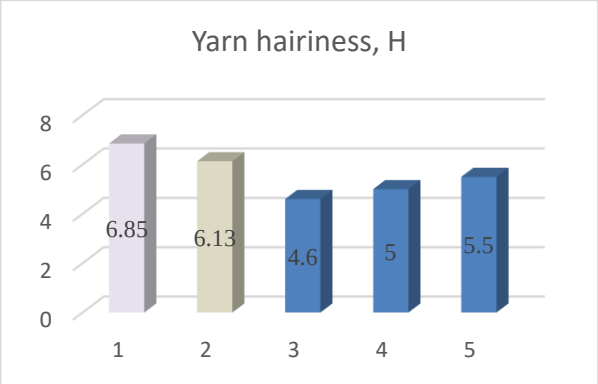

Figure 7. Hairiness indicators of threads:

1. Factory machine speed 17,000 rpm 2. Coefficient of variation of thread unevenness obtained by changing the grooves of the cylinder to 80 for machine speed 17,000 rpm 3. 5% indicator of Uster statistic 2023 4. Uster Statistic 2023 25% Indicator 5. Uster Statistic 2023 is a 50% indicator

In the course of research, it is known that when the speed of the ring spinning machine reaches 17000 rpm, the hairiness index of the spun yarn produced at the enterprise is 6.85 H, and the hairiness index of the spun yarn obtained by changing the rifle grooves to 80 is 6.13 H. It's done. Based on the results obtained above, when comparing the Uster Statistik 2023 with the indicators, it was found that 75% of the Uster Statistik corresponds to the league when the rifling grooves of the firing cylinder are changed to 80.

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Conclusions

In the course of the research, it was found that when comparing the hairiness indicators and neps indicators of yarns produced at the enterprise and the angle degrees of the producing rifle cylinder, compared to the yarn obtained by changing the groove degrees of the producing rifle cylinder, compared to the yarns produced at the enterprise it was found that the hairiness index improved by 11% and 39%.

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