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Comparative Analysis of Threads Waste in Re-Winding Machines and Automats

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Abstract: *The article explores ways to reduce waste based on an analysis of the amount of waste in various re-winding equipment and the need to take into account the subsequent use of the yarn made in the re-winding process.*

Keywords: rewinding, weft,warp, automats, machines, garbage, tube, length of waste threads, raw material, storage, automatic error, limit, target.

Introduction

Costs for yarn weaving are several times less than direct weaving. However, the amount of waste generated during the preparation process is much greater than the amount of waste directly in the weaving loom. However, 70 to 75% of tissue cost is associated with raw materials consumption.

In some cases, improved technology, along with improved labor and equipment productivity, also contributes to increased emissions. In particular, there has been some research reported that the amount of waste produced by the winding machines is greater than that of the winding machines.

Materials and methods

These studies investigated waste from wool spinning on Belgian "Jilbos", Italian"Savio" and "Autosuk" Czech machines and M-150 Russian rolling machine. Analysis of the results revealed that the line density was 45 times higher than that of the M-150 rewinding machine, 6 times more than the Belgian company "Jilbos" and 5 times the Italian "Savio" machine [1].

The surveyed machine guns are the first type of classification, meaning they are automated to replace the empty tube fill and eliminate the rope disruptions.

And the yarn unbalance control is mechanically mounted, which means the number of disruptions is close to the number of disruptions in the wrapping machine.

There is a possibility of installation of electronic controllers on modern automatic rigs, as a result of elimination of disruptions established base, increase of number of disruptions per unit of length.

These disruptions are first of all determined by the number of binding joints corresponding to the length of the rolling pack and the number of end joints associated with the replacement of the rollers. The number of disruptions in their turn depends on:

- to tie the ropes in the tube;
- the number of disruptions connected by the rolling of the thread from the tube;
- the number of disruptions from the free space;
- the number of unrelated disruptions at the first attempt;
- number of disruptions not connected in the second attempt;
- The number of disruptions connected by the wiper operation is caused by

After two attempts to eliminate the disruption in 3- and 4-stage types of modern automats, the tube is removed from the mounting position and mounted on a transparent device. The residue in the tube is then found and brought back to the packaging unit. If the tip of the tube is not found, the residual rolls will be removed from the tube and sent to the waste collection unit. The aforementioned features of winding machines affect the amount of waste they contain.

Our research was based on cutting-edge wrapping machines manufactured by German “Autoconer” and “Murata” (Japan), which have electronic filtration and knitting threads.

Results and discussion

As a result of the study of the specificity of winding machines, the amount of waste not only varies in the packing machine and machine, but also in the different types of machines.

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Table 1 shows the Re-spining Machines and machine Waste Detection formulas and the standard lengths of waste threads

№	. Type of winding equipment	Waste formulas and Normative values		Source
1.	M-2-M	$O_{\Pi} = [\frac{l_1 + l_2 + l_3 + l_4 \cdot \frac{D_1}{100}}{L_н} + \frac{(l_1 + l_2 + l_5 \cdot \frac{D_2}{100}) \cdot D_3}{10^6}] \cdot (100 + A_H),\%$		[2]
		l_1 = 0,5 l_2 = 0,75; l_3 = 0,5 м; l_4 = 10 м; l_5 = 5 м;	Total = 16,75 м; D_1 = 10 %; D_2 = 20 %; D_3 = 4 у/10000.	
2.	Autoconer, Autosuk	$O_n^1 = [\frac{l_1 + l_2 + l_3 + \frac{l_5 \cdot D_4 + l_6 \cdot D_5}{100}}{L_n}] \cdot 100 + \frac{1}{10^6}[K_{\Pi}(l_2 + l_3) \cdot$ $\cdot (1 + \frac{D_6}{100} + \frac{100 - D_7}{100}) + K_{\Pi} \cdot l_4 \cdot \frac{100 - D_6}{100}] \cdot 100,\%$		[2]
		l_1 = 0,5 м; l_2 = 0,2 м; l_3 = 1,0 м; l_4 = 1,2 м; l_5 = 1,0 м; Total ≈ 4 м;	l_6 = 130 м; D_4 = 5 %; D_5 = 7 %; D_6 = 8 %; D_7 = 85 %.	
3.	Autosuk, AMK	$У_{ма} = [\frac{l_1 + l_2 + l_3 + (l_2 + l_3)r + (l_2 + l_3) \cdot r \frac{b}{100} + (l_2 + l_3 + l_4) r \frac{100 - \eta}{100}}{L} +$ $+ \frac{(l_5 n + l_6 m)/100}{L} + \frac{g}{G}]100$		[3]

		$l_1 = 1{,}0$ м; $l_2 = 3{,}0$ м; $l_3 = 1{,}0$ м;	$l_4 = 1{,}2$ м; $l_5 = 2{,}1$ м; Total ≈ 8,3 м; $l_6 = 130$ м.	

Formulas, lengths of threads wrapped in tube and coil when determining waste in packing machines and automats, eliminating thread tips.

In the winding machine:

- The length of the rope threaded in the storage;
- the average length of the threads to be exhausted as a result of the absorption of balls in defective threaded tubes;
- Percentage of tubes not welded to the end,%;
- Share of defective tubes,%;

In winding machines:

- the length of the thread pulling from the tube to connect the rope with an automatic error;
- The average length of the thread in a tube that is not used, discarded, and cannot be put into the storage;
- the average length of the residual thread in the tube;
- tube ends without threads,%;
- Percentage of tubes that have been reworked by the tubes removed after 2 attempts;
- percentage of successfully reconnected threads,%;
- The accuracy of automatic machines,%

An analysis of the values in Table 2 shows that the threads (,,) associated with thread binding are within 0.5 to 1.5 meters of automatic rifles.

The maximum length of waste in both the winding machine and the automat is the residual rolls in the tube. Specifically, the third level automats are standardized at 130 meters.

With a view to finding ways to reduce the wastes were calculated on the basis of their operational values and calculated on the basis of normative lengths.

Experimental researches were carried out in the educational production laboratory of the department of spinning of natural and chemical fibers of the Institute of Textile Technology «Autoconer», «Technology of textile and design» «Murata» and «Murata» for the foreign enterprise “Spentex”.

Automatic waste is measured by the length of the threads taken from their bunkers. One hundred threads from each automat were found to vary in length from 0.2 to 2.8 meters.

In accordance with the standard lengths, the test strands were divided into three classes by length and summarized in Table 2.

The amount of waste in the winding machines installed at various enterprises table 2

№	Indicators		Tashkent Textile and Light Industry Learning lab. Autoconer	Tashkent Textile and Light Industry Learning lab. Murata	Spentex . Murata
1.	Total number of threads tested		100	100	100
2.	Grade 1	Number of treads	56	74	43
3.		L max, м	0,95	0,97	0,39
4.		L min, м	0,20	0,31	0,07
5.		L mid, м	0,65	0,61	0,18
6.	Grade 2	Number of treads	15	7	39
7.		L max, м	1,47	1,36	0,91

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8.		L min, м		1,14	1,01	0,51
9.		L mid, м		1,30	1,20	0,74
10.	Grade 3	Number of treads		29	19	18
11.		L max, м		2,80	1,98	2,71
12.		L min, м		1,65	1,51	2,01
13.		L mid, м		2,15	1,75	2,49
14.	Amount of waste	Normal	weft	0,32	0,32	0,32
			warp	0,16	0,16	0,16
		Practical	weft	0,52	0,47	0,31
			warp	0,26	0,23	0,15

The first class included wastes of 100 cm in length, yarns of 100 cm to 150 cm in the second class and 150 cm in the third class. In all three automatic rifles, the 1st class endings are the largest. The mean values of the lengths of each class were calculated for the calculation, and the waste quantities from the formulas in Table 1 were calculated.

The length of the thread in the tube provided by the spinning machine is T = 25, Ln = 2600 m. T = 50 for the warp, Ln = 1294 m. received. The results of the calculations are shown in Table 2.

From the analysis of Table 2, the length of the threads from the automats is 20 cm to 280 cm and is close to the standard lengths. The amount of waste is increasing due to the high number of threaded joints.

Absence of normality (l6 = 130) at the exhaust ends, attributed to the 1,2,3 stage of the experimental machines.

There is an increase in the standard emissions of all machines (0.16 per wrap, 0.32 per weft), and 0.017 per winding machine [1].

In installed machines at factories, the amount of actually detected wastes is much larger than the norm, especially for weft. The difference in the amount of waste at different enterprises is due to the difference in machine settings.

Conclusions

1. It is observed that the amount of waste generated by machines during packing is related to the adjustment of the computer system.
2. Given the requirements for the quality of the rope, the amount of waste can be reduced by changing the cutting limit.

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