ISSN: 2350-0328

International Journal of AdvancedResearch in Science, Engineering and Technology

Vol. 5, Issue 12, December 2018

Study of the Effect of Wear of the Strap Pair on the Quality of the Yarn Produced

P.M.Butovsky

Senior teacher of the department "Technological Machines and Equipment"

ABSTRACT: In this article, we consider the wear of the straps of exhaust devices of ring spinning machines; a formula has been developed for predicting the service life of the straps.

KEYWORDS: yarn, wear, straps, exhaust device, speed, pressure.

I. INTRODUCTION

Like all parts and mechanisms in motion, the straps of exhaust devices also wear out, which leads to their premature failure.

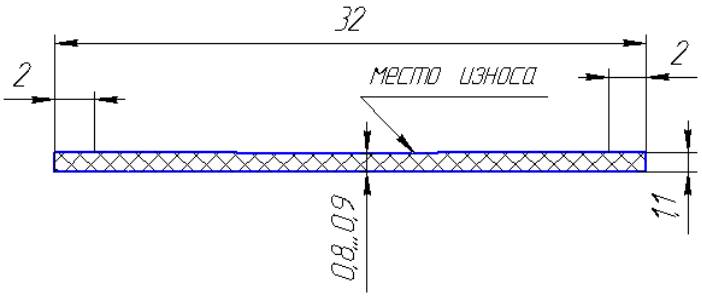
The result of the strap wear is the groove made by the product. The appearance of the groove on the strap increases the value of additional unevenness of the product. In order to increase the service life of elastic coatings, the vodilka mechanism was introduced into the design of ring spinning and roving machines. Making a reciprocating motion along the axis of the roller, Vodilka provides uniform wear elastic coatings. In order to avoid overshoot of the product of elastic coatings, the driver does not reach the borders of the strap about 2 mm.

II. LITERATUREREVIEW

The authors [1,2,3] in their works noted about the influence of the state of elastic coatings on the quality of products. They stressed that the wear of coatings increases the unevenness of the yarn produced. The author [4] paid great attention to wear and strength of elastic coatings. He noted that with the wear of elastic coatings leads to their premature failure.

III. EXPERIMENTAL PART

The strap wear pattern is shown in fig. 1. From the figure it can be seen that there is no wear at the edges of the strap.



Measurement of the strap wear after 3 three months of work; the produced yarn is 25 Tex and hood 30.

Fig.1

ISSN: 2350-0328
International Journal of AdvancedResearch in Science, Engineering and Technology
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The main wear of the strap comes from the interaction of the strap with the product. Compared to product wear, wear caused by interacting with exhaust mechanisms is not significant. According to reference data, the average resource of the strap is from 4 to 14 months, depending on the version and technological parameters.

With the increase in wear of the strap increases the value of the unevenness of the product. Worn strap can not be removed, but the introduction of the design

exhaust instrument changes contribute to an increase in their service life. To determine the effect of wear on the unevenness of the product, we conducted tests. We took worn out straps with different service lives and made 25 Tex yarn on them and measured its unevenness (Table 1). After processing the experimental data using the program Statistica 7, we obtained the relationship between the unevenness and the mass of wear:

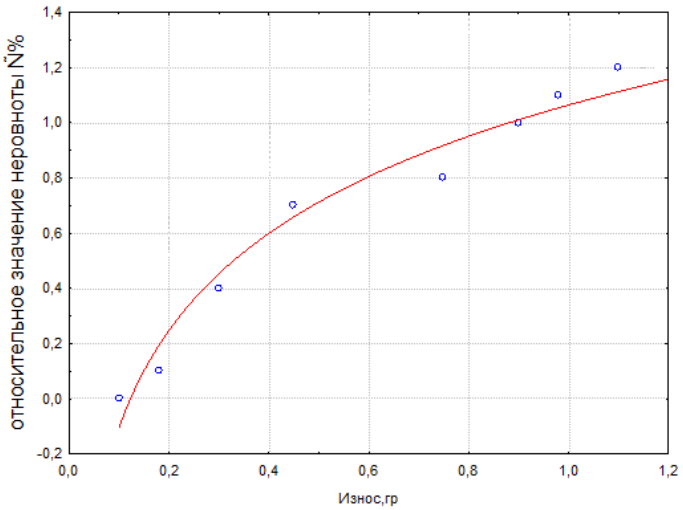
$$\Delta C = 1{,}0641 + 1{,}1672 * \lg(m) \qquad (1)$$

Where m -is the mass loss in the strap, gr.

Table. 1
The dependence of the unevenness of the product from the wear of the lower strap

Relative weight loss in the strap, gr.	Relative increase in bumps, C%
0,18	0,1
0,3	0,4
0,45	0,7
0,75	0,8
0,9	1
0,98	1,1
1,1	1,2

From Figure 2 it can be concluded that the level of the product is directly proportional to the decimal logarithm of wear. Worn strap leads to a decrease in contact between the straps and control over the fibers. Due to the loose contact between the straps, the strength of the friction force field, there are not enough forces to hold short fibers and they go to a higher speed before reaching the transition point. Lifetime, determined by wear, the strap can be predicted.



Graph of the increase in the roughness of the product from the wear of the lower strap
Fig. 2

ISSN: 2350-0328
International Journal of AdvancedResearch in Science, Engineering and Technology
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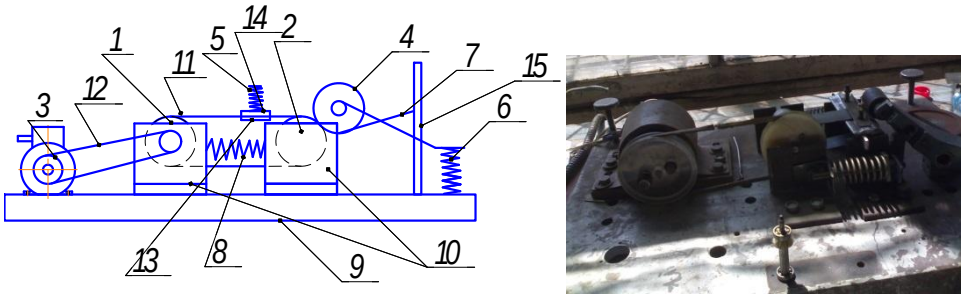
The wear of the strap associated with the contacting of the working bodies of the exhaust device with each other is less significant compared with the technological wear of the strap when it interacts with the product; therefore, we have investigated only technological wear.The study of the strap wear process when interacting with the product was carried out on a stand specially made by us (Fig. 3).



Stand device test strap for wear

Fig. 3.

The stand consists of a platform 9, on which the supports 10 are fixed. Rollers 1 and 2 are mounted on the supports, on which the strap 11 is fitted. side of the platform relative to the motor mounted pressure roller 4. The pressure between the roller 4 and 2 is carried out through the lever by the spring 6. On the right support of the stand the lower table 1 is installed Well 5. On the lower side of the foot glued a piece of strap to simulate the work of the exhaust device. On the rod 15, which is installed behind the pressure roller, a twisted product is mounted.

Before the experiment, the tested sample was weighed on an analytical balance with a fission accuracy of 0.001 g. Next, the strap was installed on the stand. The spring 11 created a preliminary tension of 1.2 kg. After that, the pressure roller was pressed against the roller 2 with a load of 10 kg. Heel 14 was loaded with a force of 0.5,1,2,3,4,5,6,7N.

After that, the stand was started and stopped every 1 h. The strap was removed and washed from wear products. After drying, the strap was weighed. Then the strap was installed in the exhaust device of the ring spinning machine, made yarn and stopped its unevenness. The basis of the strap was selected time from the recommended period of his life. The relative sliding speed in the tests was: 10; 20; thirty; 40; 50; 70; 80 and 100 min-1.

During the experiments, the following factors were taken into account: the relative sliding speed of the fiber on the strap; product density; load presser foot; strap material; product material.

The results of experiments on the wear of the strap for the month of work in the development of 25 Tex yarn from the load are given in table. 2 and Figure 4.

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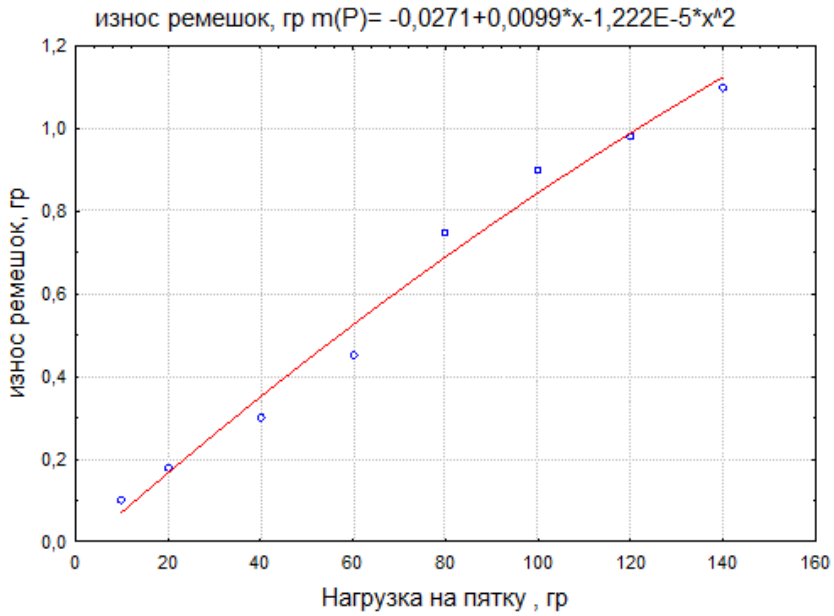

Graph of the wear of the strap from the load
Fig.4.

Table 2.
Worn strap exhaust device from the applied load

Heelload, H.	Wornstrap, gr.
10	0,1
20	0,18
40	0,3
60	0,45
80	0,75
100	0,9
120	0,98
140	1,1

As can be seen table. 2, the amount of wear of the strap of the exhaust device directly depends on the load applied; if the load is applied to a load of 10N, the wear of the strap is 0.1 grams, while the load is applied to 140H, the wear of the strap is already 1.1 grams, and from fig. 16 it follows that the wear curve of the exhaust strap from the applied load is parabolic in nature, which is expressed by the following relationship:

$$m(p) = -0{,}0271 + 0{,}0099\ p - 0{,}000012\ p^2 \qquad (2)$$

The results of the strap wear experiments for the month of work in the development of 25 Tex yarn on the relative slip speed are given in Table. 3 and in Fig. 5.

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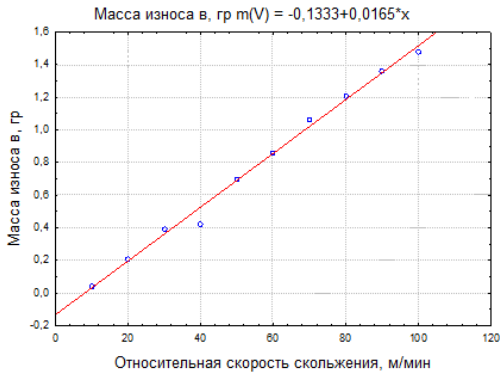
Table 3.
Worn strap depending on slip speed

Relative sliding speed V2 = a (V1), m / min.	Wear, gr
10	0,04
20	0,21
30	0,39
40	0,42
50	0,7
60	0,86
70	1,06
80	1,21
90	1,36
100	1,48



Graph of strap wear versus product slip speed
Fig.5.

As can be seen table. 3, the amount of wear of the strap exhaust device depends on the sliding speed. At a sliding speed of 10 m / min, the wear of the strap is 0.04 g, while at a sliding speed of 100 m / min, the wear of the strap is already 1.48 g, and from fig. 5 it follows that the wear of the exhaust strap from the sliding speed is straightforward, which is expressed by the following relationship:

$$m(V) = -0{,}1333+0{,}0165*V \quad (3)$$

To take into account the density of the product in both formulas, you must enter a correction factor:

$$K= T/25 \quad (4)$$

Where T- is the density of the product, in Tex.

Combining formulas (3) and (2) into one common we get the overall picture of wear, which can be represented as follows:

$$m(p,v) = \left(-0{,}0271+0{,}0099p-0{,}000012p^2\right)\left(-0{,}1333+\frac{V}{0.0165V_0}\right)tK\frac{T}{25}\alpha \quad (5)$$

Where K is a constant coefficient depending on the material of the strap; L-coefficient, depending on the type of fiber; V_{ot} is the relative sliding rate of the fiber; p-specific pressure, g / mm; t-time of working time, months;

P-load on the strap pair, kg

The results table.4, prove that when determining the dependence of the unevenness of the product on wear, it is necessary to take into account such an important factor as the density of the product. With an increase in its density, as can be seen from Table 4, the relative wear of the strap also increases. Analysis of the results in the table also

ISSN: 2350-0328

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indicates that when the yarn is 29 Tex, after 6 months of strap operation, the unevenness of the yarn will go beyond the allowable values (15% across Uster).

To determine the unevenness imposed on the product over the course of time, combine the formulas (5) and (1) as a result of which we obtain the following relationship:

$$\Delta c = 1{,}0641 + 1{,}1672 * \lg\left(\left(-0{,}0271 + 0{,}0099p - 0{,}000012p^2\right)\left(-0{,}1333 + \frac{V}{0.0165V_0}\right)tK\frac{T}{25}\alpha\right) \quad (6)$$

Table3.

Worn strap spinning machines exhaust device SKF for 3 months

Number of straps	Stretch	Density,Tex	Relative wear, %	Neps,%	Mass of straps, kg	
					До	после
100	40	50	13	2	2,1	1.84
500	50	29	10	2,1	1	0,9
40	50	58	16	1,9	0,4	0,34
20	50	87	18	1,8	0,2	0,16

IV. CONCLUSION

Using this formula(6), you can set the actual service life at a given setting. From the formula it can be seen that the wear will depend on the exhaust, pressure, density of the products. As these values increase, the strap wear increases. Due to the wear of the strap, fiber control is reduced. This leads to an increase in the roughness of the product.

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