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# Improving the Sealing Protection of Equipment in Spinning Machines

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**ABSTRACT:** The article provides an analysis of the process and elements of the roving in the drafting devices of spinning machines. An effective scheme for roving compactor is proposed. The results of theoretical studies of the process of roving according to the existing and proposed scheme are presented. The parameters of the seal are justified. The results of the experiments determined the comparative indicators of roving using the recommended roving compaction technology.

**KEY WORDS: roving**, seals, funnel, groove, friction, force, fiber, pressure, quality factor.

## I. ANALYSIS OF THE PROCESS OF ROVING COMPACTION AND THE DEVELOPMENT OF AN EFFECTIVE DESIGN

The compactor is designed to fill the roving with protruding fibers and make the roving smoother.In no case should not seal or compress roving.

The seals are located directly in front of the pairs of rollers.

In the pre-drafting field, seals are always installed; seals in the main drafting field are standard for 3-roller 2-belt drafting devices in 4-roller 2-stage stepped drafting devices; seals in the main drafting field are not used.

Instead, a shorter drafting field is established. The use of seals gives the following advantages: seals reduce the formation of fluff and pollution reduces the hairiness of roving, reduces the number of roving breaks [1].

All drafting devices use seals. In drafting devices, when the roving is drawn, the fibers are deployed, the process is complicated. Therefore, the main task of using the seal is mutual compaction of the fibers, which increases the friction between them.

This leads to uniformity when pulling roving[2].

In known constructions, the seal has the shape of a funnel. The opening of the seal in the inlet part has the shape of a circle, and in the outlet part has an oval shape [2]. The main disadvantage of the existing seal design is the lack of uniformity of compaction of roving fibers. This violates the parallelism of the fibers, which will adversely affect the process of pulling rovings, and does not allow the production of thinner threads.

In the design of the rover seal made of a friction-resistant material and having a funnel-shaped cavity inside, in order to increase the equality of the roving, it has the shape of a shaped wedge with a concave bottom wall corresponding to the radius of the cylinder on which it is supported during operation, and the outlet cavity, through which comes the roving has an oval shape and corresponds to the number of the latter [3]. The disadvantage of this design is also uneven compaction of the fibers of the roving due to the mixing of the fibers with each other, adversely affecting the quality of the yarn during pulling.

One of the main parameters of the pre- drafting field seal is the length and width of the outlet [4], while for the green color (10x3) $mm^2$; for yellow color (2x3) $mm^2$; for red standard color (14x3) $mm^2$.

For the compactor, the main drafting field with dual seals, the area of the outlet opening varies from (8x4) $mm^2$ to (17x4) $mm^2$, which depend on the color. Dual seals are effective, which allow rovings to be obtained with sufficient stretching and torsion. However, the flat working surfaces of the seals do not allow uniform compaction of the fibers due to their non-parallelism in the sealing zone.

To improve the quality of roving in the known design of the seal, a double seal is used additionally before the last pair of drafting pair of the device [4]. This allows an increase in quality indicators roving. The disadvantage of this design is the difficulty of obtaining thin filaments. Although the strength of roving increases, but the process of pulling roving is complicated.We have improved the design of dual seals for roving, ensuring the parallelism of the fibers during their compaction, especially in the lower part of the roving, where the density of the fibers is large.

The roving seal is made of a friction-resistant plastic material, has two parallel openings in the form of a funnel-shaped cavity 1, the entrance part is in the form of a circle 2, and the output part 3 is oval in shape (Fig. 1). In the lower part of the seal there is a foot 4 with a hole 5 for its fastening in the machine frame.

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On the curvilinear surface of the funnel 1, grooves 6 are made, the height of which in the entrance part will be maximum equal to $h_1$, to the output part, the height of these grooves 6 decreases to zero, in the transitional part, the height is equal to $h_2$, the distance between the axes of the funnels 1 is l = 10 mm. The step between the grooves 6 is made decreasing from the upper part to the lower part of the hole, with the step $t_1$ between the grooves in the upper part two times larger than the step $t_2$ between the grooves 6 in the lower part of the hole.

In the process of operation of the compactor, the roving (sliver) passes through the funnels 1 (holes). When this fiber roving passing through the circular entrance parts 2, gradually narrowed, compacted among themselves and leave through the oval 3 cavities of the funnel 1. At the same time, due to the longitudinal ditches 6, the fibers of the roving are held parallel in their movement in the compactor and are not mixed.

This allows in the exit of the seal due to the decreasing height of the grooves 6 from h1 to $h_2$ and to zero leads to a mutually tight contact of parallel fibers along their entire length, which increases the overall density of the roving. In addition, due to the greater density of the roving fibers in the lower part, the friction between the fibers will also be large, which can lead to their weaving, thereby reducing the uniformity of the roving. Therefore, the step between the grooves 6 is made decreasing from the top to the bottom of the hole 1, and the step between the grooves 6 in the upper part $t_1$ is twice as large as the step $t_2$ between the grooves 6 in the lower part of the hole 1. However, due to the increased number of grooves 6 in the lower part of the hole 1, a large number of fibers entering these grooves 6 remain parallel, not intertwined. This results in a quality thread.

From two parallel funnel-shaped openings 1 with grooves 6, outgoing rovings are easily intertwined in the area of their drawing and torsion. Thisallowsobtaininghighqualityyarn.

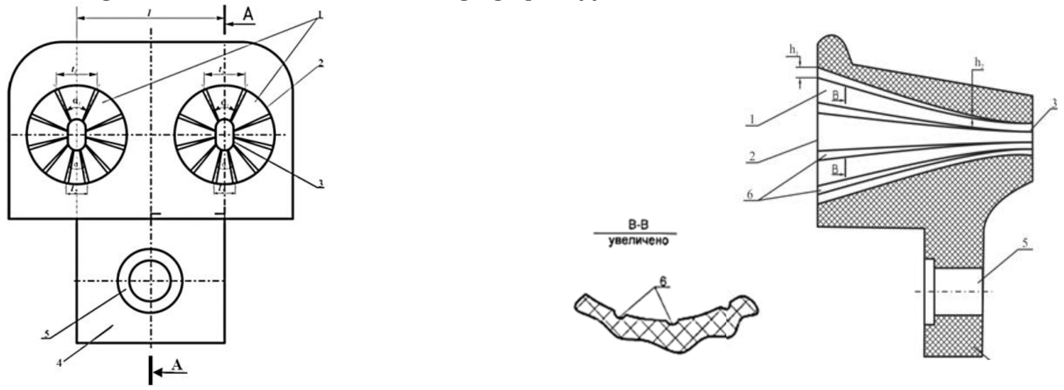


**Fig.1. Sealant for roving**

## II. METHODS AND RESULTS OF THE STUDY OF FRICTION IN THE ROVING FIBER SEAL.

In the process of compaction of roving fibers, the main parameter is the friction force between the fibers and the influence on it of the geometric parameters of the compactor. In fig.2 shows the design scheme seal roving. In the process of compaction of the rove along the length of the seal, the pressure N between the fibers increases and, accordingly, the friction force $F_{fr}$ between the fibers increases. The total value of the friction force between the fibers depends on the following parameters: the size of the funnel, the material of the fibers (friction coefficient), the number of fibers that are simultaneously in the funnel, the parameters of the grooves.

Considering that the outlet cross-section is 2-3,3 times smaller than the cross-section of the inlet of the funnel, taking into account the angle of inclination α forming the funnel, and the coefficient of friction between the fibers, the generalized friction force will be:

$$\mathrm{F_{fr}} = (2{,}0 \div 3{,}5)(n-1)fNcos\alpha \qquad (1)$$

where n- is the number of fibers in the seal funnel, f-coefficient of friction between the fibers, N-pressure between the fibers, α-angle of inclination of the forming funnel.

It should be noted that the size and number of grooves of the seal, as well as the number of weaves of fibers between them, also affect the friction force between the fibers. These parameters were taken into account by introducing the coefficients in (1).

Then we have:

$$F_{\mathrm{fr}} = (2{,}0 \div 3{,}5)(n-1)fNK_1K_2\cos\alpha \qquad (2)$$

Where K1-coefficient taking into account the effect of the grooves on the friction force between the fibers.

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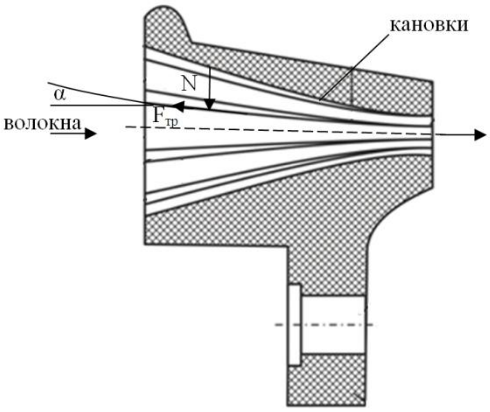
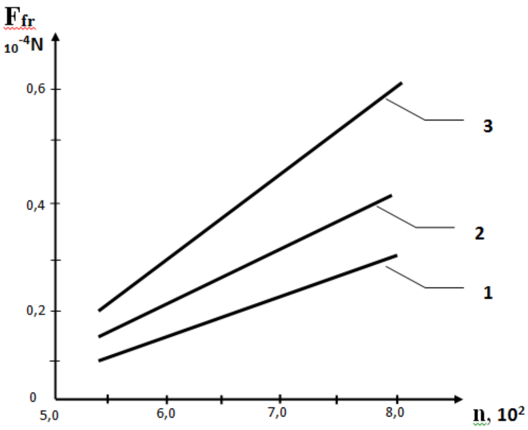



**Fig.2. Design scheme.**

According to [5,6,7], we accept K1 =0,85÷0,95. The presence of grooves significantly impede the appearance of weaves of fibers, while maintaining their parallelism, therefore we take K2 = 0,75 ÷ 0,80

Numerical solution (2) was carried out with the following initial values of the parameters compacted: the ratio of the areas of sections of the inlet and outlet,
Sin / Sout = (2,0 ÷ 3,5); n = 650 ÷ 700; f = 0,2 ÷ 0,45 (cotton, nylon, mylarfibers);
$\alpha$ = 30 ° ÷ 45 °; N = (0,2 ÷ 0,3) $10^{-4}$ H. (taking into account the fiber mass).

In the process of compaction roving in spinning machines in a single funnel (hole) are a different number of parallel fibers. In the average, in the existing compactors there are 680÷700 fibers [7]. The greater the number of fibers, the higher the density, the friction between the fibers increases. In this case, weaving of fibers can also occur and, thus, to a decrease in the quality of the thread obtained. Fig.3 presents the graphic dependences of the change in the total friction force on the change in the number of roving fibers.




**1-at f = 0,22 – 0,3 (cotton fiber); 2-at f = 0,3 – 0,4 (nylon fiber); 3-at f = 0,35 – 0,48 (mylar fiber).**
**Fig. 3. Graphic dependences of the change in the friction force of the fibers in the seal funnel on the change in the number of fibers.**

An analysis of the graphs obtained shows that with an increase in the number of cotton fibers of the roving to 840, the total friction force of the fibers in the compactor increases from $0,084 \cdot 10^{-4}$ N to $0,31 \cdot 10^{-4}$ N (Fig.3, curve 1) according to a linear pattern. When compacted on nylon fibers, the value of $F_{fr}$ is up to $0,423 \cdot 10^{-4}$ N, and for polyester fibers it is up to $0,59 \cdot 10^{-4}$ N.

Therefore, to reduce the total friction force of the fibers in the compactor, thereby carrying out the processes of drawing out and twisting the rove become more favorable, allowing for the production of a high-quality thread. For this

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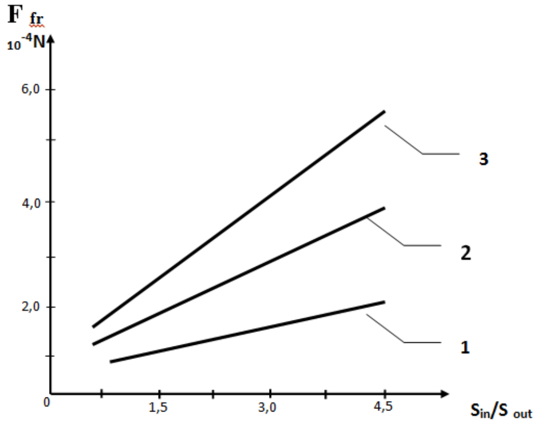
purpose, it is advisable to mix natural, especially cotton with artificial fibers. At the same time, the friction force between the fibers is sufficiently reduced during compaction, drawing and torsion of the roving.

Important are the studies to determine the generalized friction force between the fibers of the roving in the compaction process from the change in the cross-sectional area of the aperture funnel. The obtained graphical dependences of the change in the generalized friction force between the fibers during compaction of the roving on the change in the cross-sectional area of the holes in the funnel are shown in Fig.4. It can be seen from them that the greater the difference in the area of the holes, there is a significant friction force between the fibers.



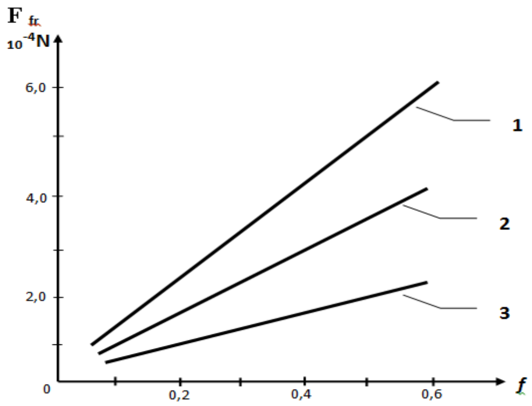

**1-when.α = 25º; 2-at α = 35º; 3-at α = 45º.**

**Fig.4. Dependences of the change in the generalized friction force between the fibers during compaction of the roving on the change in the areas of the cross sections of the holes in the funnel**

This is explained by the fact that this increases the contact area between the fibers, there are additional pressure forces between the fibers. Therefore, to reduce the total friction force between the fibers in the compaction process, it is advisable to reduce the difference between the cross-sectional areas of the holes in the funnel. To ensure $F_{fr}$ within less than $(2,2\text{-}2,5)\cdot10^{-4}$ N, $S_{in} / S_{out} = (2,5\div3,5)$ and $\alpha\leq(30^o\div35^o)$ are recommended.

The change in Ffr during the process of compaction of roving fibers largely depends on the number of grooves and weaves of the fibers. Fig.5 presents the dependences of the change in the friction force on the change in the coefficient of friction between the fibers. Upon receipt of the thread of fibers with a high coefficient of friction leads to a significant increase in the total friction force.

But, at the same time, the use of grooves and thus a reduction in the weave of fibers sufficiently leads to a decrease in the intensification of the increase in $F_{fr}$ with increasing f (see Fig. 5, curves 2 and 3). To ensure $F_{ft}\leq(2,2–2,5)\cdot10^{-4}$ N at $f\leq(0,4–0,45)$, the recommended values are: K1 = 0,9÷0,95; K2 = 0,75÷0,80




**1-when K1=0,85; K2=0,70; 2-when K1=0,90; K2=0,75; 3 when K1=0,95; K2 = 0,80;**
**Fig.5. The dependence of the friction force on the change in the coefficient of friction between the fibers.**

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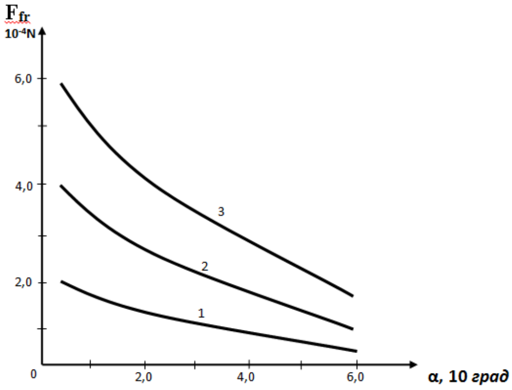
It should be noted that the main geometrical parameters of the roving seal funnel are considered; the length of the funnel, the size of the holes, and the angle of inclination of the generatrix of the taper of the funnel. In Fig.6. The dependences of the change in Ffr on the variation of the angle α are given when compacting a roving made of various fibers with different friction coefficients. As noted above, to justify $F_{fr} \leq (2,2 \div 2,5) \cdot 10^{-4}$H, the recommended values are α≤40º.

### III. ANALYSIS OF THE RESULTS OF COMPARATIVE EXPERIMENTS SEALANTS ROVING.

To study the effectiveness of the recommended rover compactor with grooves of drafting devices of roving, spinning machines, several variants of the designed compactor were made.
Comparative experiments in the Zinser 351 machines under production conditions were given.




**1- Cotton fiber; 2-copron fiber; 3 polyester fiber,**
**Fig.6. Graphs of friction force change from increasing the angle of inclination of the forming funnel seal**

Parameters were measured under conditions of spinning production, and the results were processed in a special laboratory. The results of the comparative experiments are presented in Table 1. The analysis of the indicators presented in Table 1 shows that virtually all the numerical indicators of the parameters of the yarn obtained are improved when using the recommended roving compactor.

### IV. PHYSICAL AND MECHANICAL PERFORMANCE

Table 1.

| № | Parameters | Present compactor | Recommended seal | Difference |
|---|---|---|---|---|
| 1 | Yarn linear density, tex | 29,5 | 29,5 | |
| 2 | Yarn number, Ne | 20/2 | 20/2 | |
| 4 | The number of yarn twists, n | 860 | 685 | |
| 3 | Irregularity in cross section,%<br>- linear, Um<br>-quadratic, Cm | <br>10,54<br>14,50 | <br>11,42<br>13,36 | <br>-0,88<br>1,14 |
| 4 | ComplianceCm / Um | 3,96 | 1,94 | 0,26 |
| 5 | Breaking force, N | 4,18 | 4,33 | -0,15 |
| 6 | Relative breaking strength, sN / Tex (RKM) | 14,17 | 14,67 | -0,5 |
| 7 | Elongation,% | 4,74 | 4,47 | 0,27 |
| 8 | Breaktime, sec | 0,3 | 0,3 | |
| 9 | Thickened places:-50% u / km | 4 | 1 | 3 |
| 10 | Thickened places: + 50% u /km | 145 | 71 | 74 |
| 11 | Nepses: + 200%, units / km<br>+ 280% u / km | 62<br>13 | 62<br>14 | <br>-1 |

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So, when using a seal with grooves, the number of yarn twists is 685, versus 560 in the existing version. The breaking strength is increased by 0,15sN / tex, the relative breaking force is increased by 0,5sN / tex. Elongation is reduced by 0,23% compared to existing options.

## V. FINDINGS

Based on the analysis of existing structures of the rover sealing, an efficient circuit design with grooves was developed. Based on theoretical studies, an expression is obtained to determine the total friction force between the fibers. Graphic dependences were constructed and the parameters of the seal were substantiated; the comparative experiments confirmed the effectiveness of using the seal with grooves for the roving.

## REFERENCES

1. HandbuchManual.Zinser351/Saurer Spinning machine, Germanya 2005 years, 254 p.
2. H.Ibragimov and others "Spinning machines", Tashkent, "Teacher" 1985, 182b.
3. L. G.Bekker, iA.Tkachenko "Uplotnitel, naprimer, dlyarovnitsy" avtovid № 136652, № 5, 1961.
4. Patent USA Number: US 7,913,483 B2 Mar. 29,2011
5. Q.Jumaniyazov, S.L.Matisailov,.and so on. "Technology and equipment of textile products" G.Gulom. Tashkent 2012.
6. A.Pirmatov, S.L.Matisailov,."Technology of spinning" Tashkent 2018.
7. T.B Murodov, V.T.Isakulov, NISA polygraph "Technology of pilaf and stacking". Tashkent-2017