ISSN NO: 2770-4491
Date of Publication:26-05-2023

Study of the Effect of Saw Gin Raw Material Roller Density on Fiber Quality Indicators

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Abstract. In the article is analyzed the technological process in the working chamber of the saw gin. Based on the data on the density and kinematics of the raw roller, the interaction of the saw and the raw roller is shown. The reasons for the formation of ginning defects in the fiber are shown.

Key words: saw gin, raw roller, density, fiber quality index, fibrous seeds, fibrous pure seeds, under-engineered seeds

Introduction. It is known that the density of raw materials from the practice of using saw gins affects the working performance of the machine and the quality of the product. Research on this issue has been done by many scholars with the overall results as follows:

1. The effect of the machine on the working performance. It has been proven that the growth of gin productivity necessarily occurs along with an increase in the density of raw materials. But with an increase in density, productivity increases to a certain limit, and then productivity begins to decrease. This is due to the fact that under the influence of lateral directional voltages, the rate of rotation of the raw material shaft decreases, and it has been proven that the process stops completely when the density is 550÷600 kg/m^3 [1-6].

2. Effect of fiber on quality indicators. It has been found to improve the quality performance of cotton fiber as a result of reducing the unevenness of the transfer of cotton to the cotton gin working chamber and stabilizing the ginning process [2].

The main reason for the formation of ginning defects in fiber is the excess and variable density of the raw material roller. When the density of the raw material roller increases, nodules, combined nodules and nodules are formed.

According to experimental data on the effect of raw material roller density on fiber and seed quality, the least damage to fiber is observed in Type I cotton when the raw material roller density is 325 kg/m^3, and in Type III cotton-290 kg/m^3 [1].

In order to increase cotton gin productivity and improve fiber quality, stabilization of the ginning process is necessary, and in Type I cotton, the optimal density of raw materials is 325 kg/m^3, and in Type III cotton-290 kg/m^3.

Analysis of the technological process in the saw gin working chamber. The following organizers can be distinguished in the composition of the raw materials roller:

1. fibrous seed, 2. Pure seeds purified from fiber, 3. not entirely ginning seed.

In order to simplify the analysis, we add not entirely ginning seeds to fibrous or pure seeds, depending on the amount of residual fiber in them, then we consider that the raw material is made up of fiber and pure seeds [7].

Fibrous seeds are taken as creamy balls with a diameter of 20 mm, and pure seeds as inflexible balls with a diameter of 8 mm.

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Interaction of saws and raw materials roller. Based on the data on the density and kinematics of raw material roller [1], the interaction landscape of saw and raw material valig can be described as follows (figure 2.1).

I. The area of the point K where the saw and the raw material roller begin to affect. Saw teeth begin to interact at the point K with the raw material roller. In this case, the linear velocity vector V_a of the saw is in the direction of urination to the circle formed by the tips of the saw teeth, with which the linear velocity vector V_b of the forming feedstock wall of about 90° is in the direction of urination to that surface. This attitude of the directions and the linear speed of the saw leads to the fact that due to the linear velocity of the raw material roller 12-15 times the size of the saw teeth are intensively immersed in the inside of the raw material roller, and in this the saw teeth are able to hook the parts of the fiber In this case, one branch of fiber smoke will stick to the seed, and the second branch will have a free end. It is important that the linear speed of saw teeth is much larger than the absolute value – due to $V_a \succ (10-12)$ m/s, the interaction of saw teeth and fibers will have a shock description. This leads to the fact that on the one hand, the fibers of which the saw teeth are hooked, cling tightly to the working surfaces of the teeth and begin to act in conjunction with the teeth, and the density of the line KLM and it to the right suddenly decreases.

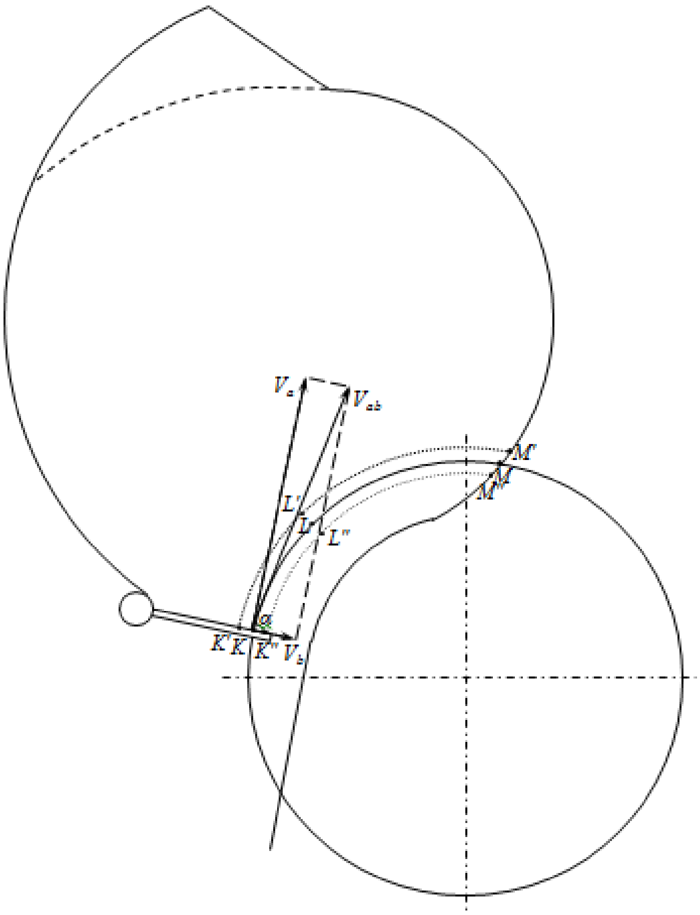

Figure 1. Scheme of interaction of saw and raw material roller

On the other hand, the seeds to which the fibers belong on the left of the line KLM , in an area where the density is large, a second blow occurs when the fibers that have been hit by their grip move them, due to their relatively firm fit. In the process of this impact, some of the fibers that pull the seed are disconnected, and the number of breaks will depend on the degree of strength of the seed location. While the strength of pollen deposition will be directly dependent on the density of the raw materials, i.e., as the density increases, the fibers become more disconnected and their lengths are reduced. The second free-end network of fiber smoke attached to the saw tooth does not meet great resistance in the point K area, and it can be said that fiber breakage does not occur in the network.

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In the area of point K, saw teeth that have sunk into the raw material shaft can in some cases be counted directly on the stalks of the seeds, scraping their surfaces. This can be considered the main factor that makes the tick bark appear a demining defect. It is self-known that the amount of this defect also increases as the density of the raw materials is increased.

Thus, the meeting point of saw teeth with the raw material wall surface K is the area in which fiber elongation and bark separation from pollen occur the most due to the fact that their interaction has a shock description.

II. The movement of fibrous seeds in the K area, where saw teeth move immersed in the raw material roller. In this area, the fibrous tangles that part of the fiber cover is involved in the Sawtooth follow the saw. In this the sum of the vectors of the surface velocities of the Saw and the raw material roller is V up and left, and the fiber particles move in Area $KK'L'L$ due to the orientation of the raw material roller into it. Where L' are the $K'M'$ and $K''M''$ lines to which the point belongs are the ekvidistant lines to the KLM arc whose intervals can be taken to be equal to the diameter of the shear sphere. As a result of the penetration of fibrous seeds that follow the saw between the previously moving fibers and pure seeds in this area, the density here begins to rise sharply, both in terms of distance and in terms of time. In this, the density increases with an increasingly large velocity from point K to point L, while in the field the rate of growth decreases even if the density increases. At KLM and M, the density is maximal in terms of raw material volatility, while on the right side, on the contrary, a sharp decrease in density occurs. Under these conditions, the fibrous tangles moving with the saw continue to move by compressing from the left side of the KLM arc to the right-hand side area. Thus, the fibrous tangles involved in the saw move in an arc-like area bounded by the $K'L'M'$ and $K''L''M''$ curves. In the course of this movement, the bulk of the fibrous pollen moving from the KLM curve to the sparse area on the right reaches the colosnik grating, and the fibres involved in the Sawtooth in it separate from the pollen and pass through the colosnik grating. The seeds that have separated from the fiber smoke will pass through the colosnik grid if completely demonized. The seeds that have separated from the fiber smoke will slip down along the colosnik if completely jinned and go outside in the area of the tangle comb. And when the residual fiber in the grain is more, it continues to move at a lower speed by rubbing against the Saw and again merges into the raw material roller.

From the KLM curve, the part of the seeds moving in the inner area on the left that is firmly connected with the saw reaches the colossal grid with it and is demonized. In this case, only a small part of the seeds that have separated from the fiber with the lowest residual fiber will move down the grate. Incomplete unbreakable pollen with medium residual fiber is again added to the raw material roller.

Because the velocity of the saw is many times greater than the velocity of the raw material roller when the fiber seeds move following the saw in this area, a significant part of them are braking by the raw material roller. In this case, if the fiber smoke is not firmly connected to the Saw tooth, the smoke will slip out of the Saw tooth, and the fiber will continue to move with the raw material roller. When the fiber is firmly connected to the Saw tooth, the fiber will pull the fiber to the grate if the fiber smoke strength is sufficient and the raw material roller density is not too large, and the Ginning process takes place. When the density of the raw materials is large, however, the strength of the fiber is not enough to pull the fiber sediment with the velocity of the saw in a dense environment, so they are disconnected from their different places. As a result, the fiber length is reduced, the amount of residual long fibers in the seed increases.

III. Saw teeth are the movement of a free-end network of fiber that is involved in Saw tooth in the KLM area, which is immersed in the raw material roller. Due to the low density of the raw material roller in the area to the right of the KLM curve, the free end of the fiber smoke involved in the Saw tooth practically does not meet resistance.

Conclusion. So KLM from the curve in the area to the left, the free end of the fiber, which is involved in the Sawtooth because the raw material roller is dense, moves with a lot of friction with the raw material roller organizers.

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