STUDY OF THE DEFORMED STATE OF SAWS ON THEIR POSITIONS IN THE INTER-GRATE GAPES OF JIN

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Key words: *saw gin, saw, grate, grate gap, shipping, flatness, wear, grazing, runout*.

Introduction: Cotton fiber is the main raw material of the textile industry, and in this regard, it is important to develop the cotton ginning industry, namely the creation of new resource-saving equipment and technologies, which will reduce the cost of production in the world cotton market.

The main machine of the ginneries is the gin, whose main task is to separate the cotton fiber from the seeds, while maintaining its natural properties, and on the work of which both the quality of the fiber and the production capacity of the plant largely depend.

A modern saw gin (Fig. 1) is a high-performance, partially automated continuous machine, which consists of the following main components: feeder 1, consisting of a peg drum 2, feed rollers 3 and perforated mesh 4 and weed auger 5; The genie also has a scraper 6, a trough conveyor 7, an air chamber 8, a saw cylinder 9, a seed comb 10, a grate 11 and a working chamber 12 [1].

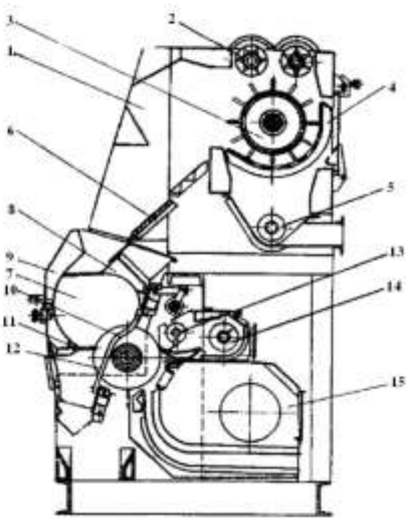

Fig.1. Saw gin

The work of a number of scientists who have made valuable suggestions to the development of the theory and practice of ginning are devoted to the issues of ginning. Of the available works, a large number are devoted to the study of the operation of the saw tooth, the raw roller, the configuration of the raw chamber, the performance of the gin, etc. [2,3,4,5].

Materials and methods: One of the important components of the gin's working chamber is the grate, the state of good condition of which largely affects the qualitative and quantitative indicators of the ginning process. However, scientific works on a comprehensive analysis of the influence of the grate or its elements on the performance of the ginning process, in our opinion, are still insufficient.

Based on the foregoing, this paper presents the results of a study of the zone of interaction of the grate with a genie saw, in order to reduce its wear. The wear of the grate in its working part leads to disruption of the ginning process and to the failure of the grate. A special place, in terms of grate wear, is occupied by the position of the saw in the inter-grate gap, because. its incorrect position leads to intensive wear of the working surfaces of the grate.

Figure 2 shows a diagram of an offset saw with respect to the grate gap. Another important indicator of accuracy is the spatial error of gin and linter saws, estimated by the deviation from the plane, which, according to the established technical conditions, should not exceed

0.5 mm. In the manufacture of saws, the accumulated internal stresses lead to significant deformation and the non-flatness of the saws can reach 1.5-2 mm or more.

All this leads to uneven fiber tension, which subsequently affects the formation of defects, such as incision, damage, etc. Consider the force acting on the fiber during ginning, with the saw displaced in the gap between the grates.

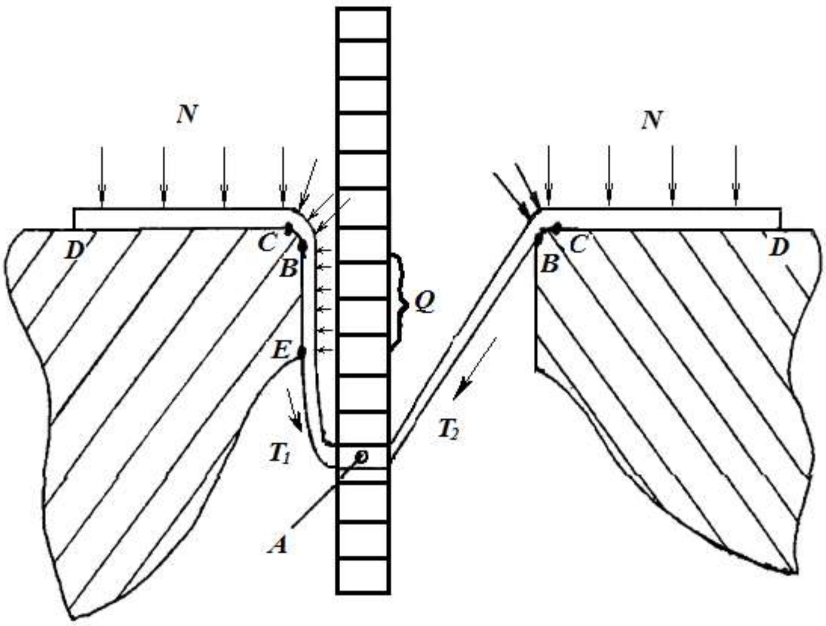

Fig.2. Fiber tension forces that occur when the saw is off-center in the grate gap.

In this case, the fiber tension is uneven, the fiber on one side is closer to the grate, and on the other side further, the angle between the branches, relative to the saw, is different, as mentioned above, this can cause a defect in the fiber, and we assume that the fiber has already come off from the seed in the raw roller, but did not have time to pass through the gap, and therefore additional wear occurs from contact interaction with the grate.

Let's make the equation of a tension of fibers for the given case. We will proceed from the fact that the fiber is pressed against the grate by a raw roller on the one hand with the force F' and on the other hand with the force F", and we will express the friction force between the saw and the grate as F'". In this case, the tensile force of the fiber will be equal to the following:

$$T_1 = F' + F'' + F''' \quad (1)$$

We express the friction force between the grate and the fiber as:

$$Fmp1 = \mu_1 P_0 L_1 \quad (2)$$

$$Fmp2 = \mu_1 P_0 L_2 \quad (3)$$

Where P_0 is the specific pressure force on the fiber.

μ_1 - coefficient of friction between the grate and the fiber, as well as the saw and the grate.

L_1, L_2 - fiber length.

And the fiber tension can be expressed through the Euler formula

$$F' = F_{mp1} e^{\mu_1 \alpha} = p_0 L_1 e^{\mu_1 \alpha_2} \quad (4)$$

$$F' = F_{mp1} e^{\mu_1 \alpha} = p_0 L_2 e^{\mu_1 \alpha_1} \quad (5)$$

In view of the close distance between the grates, we will take as 900, then in this case, (4) and (5) will take the form:

$$F' = F_{mp1} e^{\mu_1 \alpha_1} = \mu_1 p_0 L_1 e^{\frac{\mu_1 \pi}{2}} \text{ и } F' = F_{mp2} e^{\mu_1 \alpha} = \mu_1 L_2 e^{\frac{\mu_1 \alpha_2}{2}}$$

But the presence of a pressure force between the saw and the grate is expressed in the following form:

$$F''' = \mu_1 Q \quad (6)$$

where Q is the lateral pressure on the surface of the grate, depending on the rigidity of the saw.

Then formula (6) will take the form:

$$T = \left(p_0 e^{\frac{\mu_1}{2}} \left(11{,}34 L_1 + L_2 e^{\alpha_2}\right) + Q \right) \mu_1 \quad (7)$$

The tensile force of the fiber must satisfy the following conditions:

$$[\sigma_{вол}]_{доп} < \frac{T}{S} \quad (8)$$

Where S is the cross-sectional area of the fiber;

$[\sigma_{fibers}]_{addit}$ - permissible breaking load.

From formula (7) it can be seen that the tension of the fiber depends on the value of the wrap angle, and it, in turn, depends on the wear of the grate and the location of the saw. At the grate, to which the saw is moved closer, the wrap angle increases, so the probability of fiber breakage also increases.

It is known that the disconnection of the coordinates of the side surfaces of the saw and the grate from the nominal positions cause a displacement of the saw blade in the gap between the grates. In this case, a one-sided gap selection to zero is possible, and at large displacements, the appearance of an "interference", in which the saw bends when entering the grate slot, contacts with the side surface of one of the grates and, as a result of rotation, wears it out.

Conducted theoretical studies on the assessment of contact pressures during the interaction of cotton fiber with the working edge of the gin grate have shown that the tension forces of a strand of fibers, with a central location of the saw in the inter-grate gap, are approximately 1.5 times less than with an off-center one [6].

Results. If the saw blade touches the side surfaces of the grates, a normal force will appear, pressing the saw blade away from the grates, and its value will depend on the hardness of the disc. The non-central position of the saw blade in the gap between the grates will also lead to the appearance of a disc-squeezing force during ginning, since the difference in the gaps between opposite sides of the saw blade will cause it to be pressed out by a strand of fibers passing into the gap between the saw and the grate.

In this regard, it is of interest to study the dependence of the force acting on the grate on the deformation of the saw blade. Since the saw blade is warped and this leads to a change in the gap between the saw and the grate when the saw rotates, it is natural that the magnitude of the side force will also change depending on the warping of the saw blade.

From this point of view, it is of great importance to study the amount of runout of the saw blade and the amount of its deformation at various points under the action of a normal load. For this, saw 1 was fixed on a special stand (Fig. 3) on the saw shaft 2.

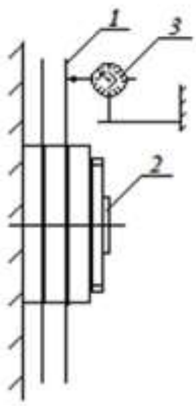

Fig.3. Saw runout measuring circuit

1 saw; 2-shaft; 3-indicator.

To study the runout, the circumference of the saw blade was divided into eight divisions. An indicator was installed on a special stand, the measuring tip of which measured the end runout of the disk at the periphery. Deviations of points on the lateral surface of the disc were measured and presented in Table 1.

Table 1.

Experimental results

Points on pov. disk	1	2	3	4	5	6	7	8
Saw blade runout, mm	0	-0,12	0	-0,43	-0,83	-0,89	-0,34	0,06

As can be seen from the table, the maximum deviation of the points of the saw blade was 0.95 mm. According to the table, the warp curve of the saw blade, shown in Fig. 4, was constructed. As can be seen from the curve, the disk has three vertices, i.e. for one revolution of the disc, the points on its surface approach and move away from the grate three times, i.e. for one revolution of the saw, the magnitude of the load acting through the strand of fibers on the side surface of the grate changes three times. Δ

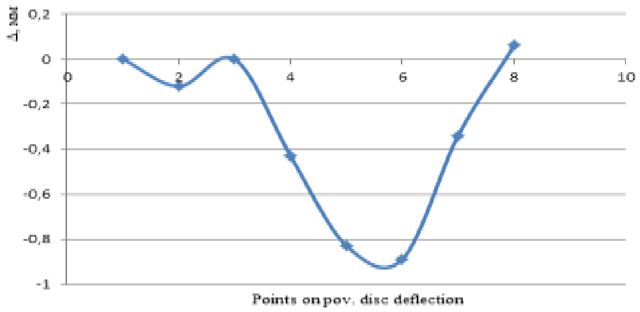

Fig.4. Warping of the saw blade

An alternating load can lead to a shift of the replaceable element of the grate. The magnitude and fluctuations of the load depend on the magnitude of the deformation of the saw blade.

Conclusion. Thus, on the basis of the conducted studies, it was found that the off-center position of the saw in the inter-grate gap leads, during ginning, to the appearance of lateral force acting on the grate. The magnitude of the force depends on the rigidity of the saw and, when it is deformed by 1 mm, it ranged from 10.8 to 12.3 N at various points. The maximum deformation of the saw under a force of 10 N was 0.92 mm, and the minimum was 0.81 mm.

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