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Determination of Self-Ejection of Fiber from the Saw Teeth of the Developed Fiber Cleaner

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ABSTRACT: The article presents the data of theoretical studies to determine the self-discharge of fiber from the teeth of the saws of the developed fiber cleaner. In contrast to previous studies, in this work, in determining the angle of the front face of the tooth to the radius of the saw city walks spatial arrangement strand fiber on the tooth pill of bolognaises. Derived graph of the angle of the front face of the tooth to the radius of the working body, depending on the angle of deviation of fiber strands at a known coefficient of friction on steel fiber.

KEYWORDS: fiber cleaner, theory, grate, placement step, cleaning effect, fiber, ulyuk.

I.INTRODUCTION

From domestic designs, fiber cleaning machines of direct-flow action, with the supply of fiber to the working body directly after in the loosened state, individual single and multi-stage, have become widespread due to the simplicity of the device and high efficiency of work.

After the transition of cotton gins to larger and more productive gins of the DP-130 type, the fiber cleaners developed for them began to work unreliably (after 1-2 shifts of work, the gaps between the saw cylinders and the grates are broken and naturally they are reconfigured again).

The fiber cleaners for DP-130 gins have the following disadvantages::

1) There is a decrease in the rigidity of the saw cylinder.
2) The weight of the saw cylinder reaches 500kg.
3) There is a very poor balancing of the saw cylinder.

All this leads to:

1) Vibration of the saw cylinder of the fiber cleaner.
2) Violation of the gaps between the saw cylinders and the grate bars.
3) Reduce the cleaning effect of the fiber.
4) Increase in the mass of fiber in the waste after the fiber cleaner.
5) Failure of bearing assemblies before their service life.
6) Increasing the fiber faces in the grate.

Based on the results of the work carried out, the design of a new fiber cleaner was developed in JSC "Pakhtasanoat Ilmiy markazi" (Fig. 1).

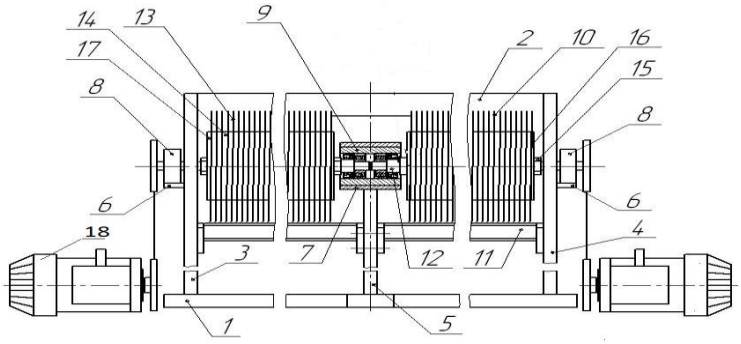

Fig 1. Schematic diagram of the new fiber cleaner design

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1-frame; 2-fiber cleaner housing; 3-4-extreme walls; 5-middle wall partition; 6 and 7-supports; 8 and 9 bearing housings; 10-saw cylinder; 11-grate bars; 12-saw shafts; 13-saws; 14-inter-saw gasket; 15-tightening nuts; 16-oblique washer; 17-key; 18-electric motor.

Designed saw palace hotel [1] consists of: frame 1, on which to fasten the housing bolognaises 2, saw 10 cylinders with bearing housing 8 and 9, grate 11 installed on the length of the body with the installation in mid-bolognaises vertical cross-section walls, partitions 5, which is attached to the bearing housing 8 and 9, the bearings separately set the ends of the saw cylinder 10, each of which has its own drive motor 18.

According to the operating conditions of the fiber cleaner, it is required that the captured fiber after passing the technological cleaning operation itself is dropped from the teeth of the saws. This requirement is feasible with the correct choice of the angle of inclination of the front face of the tooth to the radius of the working body, if the speed mode of its operation is known.

The value of the angle was determined experimentally. When selected by calculation, for example, according to the results of studies conducted by D. A. Kotov [2], the value of the angle of deviation of the strand φ depending on the speed of rotation of the saw cylinder is experimentally determined. She found that the value of the angle φ with a change in the speed of the saw cylinder from 100 to 750 rpm varies from 250 to 450. When determining the angle, it was assumed that the forces acting on the fiber strand were applied to the top of the saw tooth. In fact, the fiber strand on the tooth has a spatial arrangement, which is characterized by the angle of deviation φ (Fig. 2). Secondly, the speed of rotation of the saw drums of fiber cleaning machines is in the range of 1400-1500 rpm. Based on this, with an increase in the speed of rotation of the saw drums, it is advisable to refine these angles taking into account the working conditions of the saw drums at high speeds.The following is a theoretical calculation of determining the angle at constant values of the coefficient of friction of the fiber on the steel.

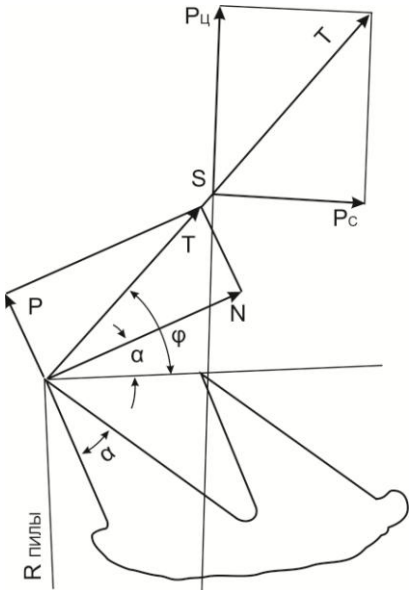

Fig 2. Diagram of the forces acting on the fiber strand

A strand of fiber captured by the saw tooth is affected by the centrifugal force Rc and the air pressure force Pc applied at the center of gravity of the strand S. The first is directed along the radius of the working body passing through the center of gravity of the strand S, the second is perpendicular to the first.

From the action of these forces, the fiber strand deviates by an angle φ from the tangent drawn to the circumference of the saw drum at the point where the fiber strand is captured by the saw tooth, and is located in the direction of the resultant of the forces under consideration. R2c

The resultant force is equal to

$$T = \sqrt{P_ц^2 + P_c^2} \qquad (1)$$

And it is transmitted by a strand of fiber to the front face of the tooth.

Decomposing this force into the normal to the front edge of the saw tooth and tangential, we see that the latter tends to throw a strand of fiber from the saw tooth.

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It is possible to determine the reset conditions from the equality of forces:

$$T\sin(\varphi - \alpha) = fT\cos(\varphi - \alpha) \quad (2)$$

Where d is the coefficient of friction of the fiber over the steel.
From equality 2, it follows that

$$f = tg(\varphi - \alpha) \quad (3)$$

After converting equality 3, we get an expression for determining the value of the angle α at which the fiber is self-ejected from the teeth of the saws:

$$tg\alpha \leq \frac{tg\varphi - f}{1 + f tg\varphi} \quad (4)$$

The analysis of formula 4 shows that as the angle of deviation of the strand increases, the angle α increases.

Since the fiber strands are buried in the mouth of the teeth at different sizes (from zero to the maximum length of the front face of the tooth), their discharge begins at different times. Least recessed strands of fibers is reset in the first place, most buried in the past. As a result, the complete fiber discharge should occur at the arc defined by the above formula.

For the values of the angle φ -550, 600, 630, 650 corresponds to the following speeds of the saw drum of the fiber cleaner: 720, 900, 1200 and 1500 rpm, based on this, the range of changes in the angle φ when calculating the given data can be taken in the range of 550-650. Based on the same data, a graph of the change in the maximum value of the angle α with the change in the angle φ is constructed (Fig. 3).

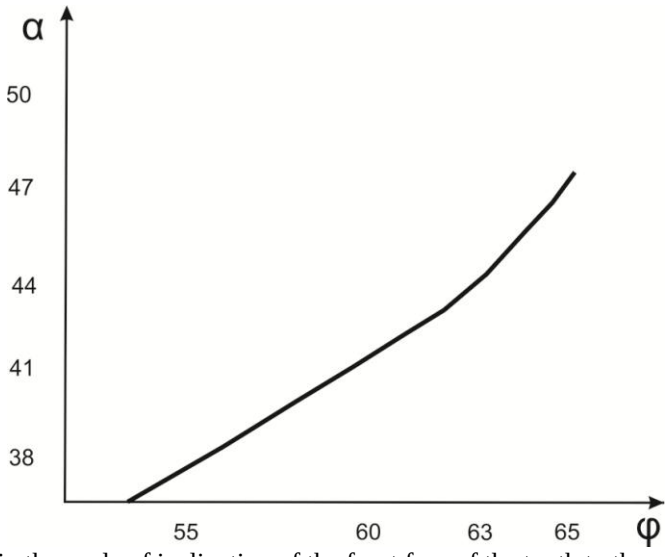

Fig 3. Graph of the change in the angle of inclination of the front face of the tooth to the radius of the working body α depending on the angle of deviation of the fiber strand φ at the coefficient of friction of the fiber on steel $f = 0{,}3$

Thus, using the formula 4 and knowing the coefficient of friction of the fiber on the steel and the angle of deflection of the strand, you can choose a reasonable angle of inclination of the front face of the saw tooth to its radius, at which the fiber strands self-throw for the selected speed mode.

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