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IMPROVING THE ELASTIC MASS OF FIBER ON THE SURFACE OF THE SAW CYLINDER IN FIBER CLEANING EQUIPMENT USING AN ADDITIONAL DEVICE

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Abstract: In the article in order to improve fiber cleaning equipment, it is proposed to improve the elastic mass of fiber on the surface of the saw cylinder in the equipment using an additional device. The scientific work on the improvement of the equipment was analyzed. In addition, it has been studied that the required 0-2 mm spacing between the clamping brush and the saw cylinder, due to the rapid wear of the clamping brush due to continuous operation of the cleaner, expands to 3-6 mm, and in some cases even more. Inadequate adhesion of the fiber to the saw cylinder, along with the impurities released when the fiber hits the colostrums, the fibers that are weakly attached to the saw teeth are separated into waste. This in turn leads to a decrease in the amount of fiber being produced. To overcome this shortcoming, it is necessary to ensure good adhesion of the fiber to the saw cylinder. For this, the equipment is equipped with a guide device that ensures that the movement of the fiber reaches the surface of the saw blade well, and its effect on cleaning the fiber is theoretically based.

Keywords: Cotton, fiber, speed , pressure , saw cylinder, guide device.

In the article, in order to improve the fiber cleaning equipment, it is proposed to improve the elastic mass of the fiber on the surface of the saw cylinder in the equipment using an additional device. The scientific work on improving the equipment is analyzed. In addition, it has been studied that the required 0-2 mm gap between the pressure brush and the saw cylinder increases to 3-6 mm, and in some cases even more, due to the rapid wear of the pressure brush due to continuous operation of the cleaner. If the fiber is not attached to the saw cylinder to the required extent, then the fibers loosely attached to the saw teeth are separated into waste along with impurities, which are separated when the fiber collides with the grates. This, in turn, leads to a decrease in the amount of fiber produced. To overcome this disadvantage, it is necessary to ensure good adhesion of the fiber to the saw cylinder. For this purpose, the equipment is equipped with a guiding device that ensures that the movement of the fiber reaches the surface of the saw set well, and its effect on fiber cleaning is theoretically justified.

Introduction. In the world, the use of energy-resource-efficient techniques and technologies for the preparation and storage of cotton made from natural fibers, as well as improving its quality, occupies one of the leading positions. "According to the information of the International Consultative Committee (ICAC), 24.55 mln. 23.07 million tons of fiber were produced. is a ton", taking into account that the grown fiber contains a certain amount of foreign impurities, a quality yarn requires a scientist by implementing the techniques and technologies that implement the work process in cleaning the grown cotton with high quality [1].

In the world experience, large-scale scientific and research work is being carried out to improve the technique and technology of the initial processing of cotton. In this field, among other things, tasks are being set to develop efficient technologies for cleaning cotton and fiber from dirty impurities, to create resource-efficient efficient equipment for drying cotton and cleaning fiber. At each stage of production, identifying factors that have a negative effect on the quality and quantity of products and technical solutions to eliminate them, development of technologies that can control product quality, and optimization of operating modes and indicators, which allow to maintain the initial quality indicators during the technological process of cleaning cotton and fiber In-depth study from the theoretical side of conducting scientific research is of great importance.

Analysis of scientific works . A number of scientists from our country and foreign countries have studied the influence of the friction force of the surface of the colanders on the separation of impurities in the fiber cleaning technology in the fiber cleaning technology, the effect of the adhesion level of the impurities to the fiber, the effect of the diameter and rotation speed of the saw cylinder on the quality of the fiber and the acceleration of the separation of impurities from the fiber, the mass moving between the saw cylinder and the corosines. studies of the impact of saw cylinders and colosniks on mass fiber in improving fiber quality indicators, the working condition of the fiber cleaner in aeromechanical, mechanical, and pneumomechanical fiber cleaning and fiber separation from the saw cylinder, the effect on the fiber being cleaned has been studied theoretically [2-5].

Search A.I. The theory of influence of the number of saw cylinders, rotational speed, distance between saws on the aerodynamic condition and fiber mass to prevent fiber damage during the separation of impurities from the fiber composition in the "direct flow" fiber cleaner proposed by Krygin [6]. Increasing the speed of the saw cylinders from 500 rpm to 1700 rpm increases the cleaning efficiency of the cleaner and improves the appearance of the fibers on the basis of theoretical and practical research. From the theoretical point of view, the number of drums, the rational sizes of the aerodynamic resistance that reduce the fiberiness of waste in effective fiber cleaning are proposed.

The applicant Yu.S. Kotov [7] studied the aerodynamic and technological parameters of a three-drum direct-flow 1VP fiber cleaner. As a result, it was theoretically determined that the aerodynamic resistance that occurs in the fiber carrier throat of the cleaner at working pressure is less than the resistance that occurs in the 3OVP three-drum fiber cleaner. Theoretical studies of the meeting of the saw teeth in the saw cylinder by the flow of fiber under the influence of the air generated during the rotation of the saw cylinder have been carried out and analytical solutions have been presented.

The applicant Yu.A. Sapon [8] studied the theory of movement trajectory in straightening after hitting the fiber in the colosnik in order to improve the technique and technology of fiber cleaning in the condenser type fiber cleaner. For this type of fiber cleaner, from the theoretical side, an equation expressing the total cleaning efficiency of the cleaner, taking into account the amount of impurities separated from the interaction of all the columns with the saw cylinder in the cleaner in the separation of impurities from the fiber in each column zone of the cleaner, is proposed.

Despite the scientific and practical research conducted by scientists and specialists in our country and abroad on improving the cleaning efficiency of cleaners and improving the quality of produced fiber, and despite the positive results achieved as a result of them, in addition to increasing the cleaning efficiency in cleaning hard-to-clean selection grade cotton fiber picked by hand and machine, the consumer's quality high indicators have not been achieved in the production of fiber that fully satisfies the demand for fiber [9].

Theoretical analysis. Existing fiber cleaning equipment in cotton mills can be modified to improve cleaning efficiency. For this, the better the fiber is attached to the teeth of saws in the saw cylinder during the cleaning process of the fiber cleaning equipment, the better large and mostly small impurities are separated from its composition when the fiber hits the colostrums. Wetting the fiber to the saw teeth is done with the help of a fixing brush on the cleaner. In the cleaner, the fixing brush wears out quickly due to constant work with the load. As a result, the required 0-2 of the fixing brush with the saw cylinder *mm* 3-6 *mm* , in some cases extending to an even larger span. As a result, the brush is almost not involved in feeding the fiber stream to the saw cylinder. Inadequate adhesion of the fiber to the saw cylinder, along with the impurities released when the fiber hits the colostrums, the fibers that are weakly attached to the saw teeth are separated into waste. This in turn leads to a decrease in the amount of fiber being produced. To overcome this shortcoming, it is necessary to ensure good adhesion of the fiber to the saw cylinder.

A guide device was developed in order to prevent the binding brush from breaking, to evenly distribute the good flexibility of the fiber to the saw cylinder.

Using the developed guide device, we consider the model of distribution and cleaning of the moving mass of the fiber flow between the saw cylinder and the compacting brush from a theoretical point of view.

Flow movement in the smoothing zone is considered two-dimensional, but considering that the flow moves mainly along the arc of the saw cylinder, we average the flow parameters relative to the generator of the saw cylinder. In this regard, we consider that the flow movement in the considered zone is one-dimensional, stationary and directed along the arc of the drum. To describe this process, we use the proposed model, in which the pressure on the surface of the element in the form of a guide device located along the length of the saw cylinder (Fig. 1) p availability is taken into account.

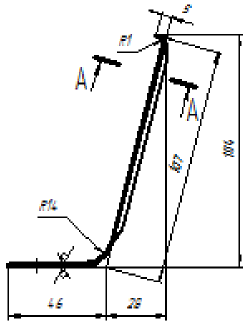

Figure 1. The installation scheme of the fixing brush and the guide device in relation to the surface of the saw head during the movement of the mass fiber under the influence of the guide device.

We set the coordinate head in the last part of the clearing zone and from this part OK we direct the arrow to the opposite side of the flow. The equation of motion of the average directed flow along the length of the cylinder is written in the following form.

$$\rho \cdot \vartheta \cdot b \frac{d\vartheta}{dx} = -\frac{d(b \cdot p)}{dx} + p \cdot c + \frac{S \cdot \sin\alpha}{L}[p_1 \cdot \chi \cdot (x - x_1) + p_2 \cdot \chi \cdot (x - x_2)] \quad (31)$$

in this $\rho = \rho(x)$, $\vartheta = \vartheta(x)$, $p = p(x)$ - average values of flow density, speed and pressure in the cleaning zone, $b = b_1 + k \cdot x$ - x The equation of the zone height change from the variable (h_0 - between the saw cylinder and the brush $x = 0$, $k = tg\alpha$ in section, α - angle of inclination of the brush), $c = \sin\alpha + fk_0 \cos\alpha$, f - coefficient of friction between the nozzle and the flow, k_0 - side pressure coefficient, $S = \pi \cdot r \cdot l_0$ - flow contact area of the saw cylinder, r - the radius of the saw cylinder, l_0 - the depth of penetration into the stream, L - the length of the saw cylinder. p_1 and p_2 - pressure on the surface of saws located in two rows along the length of the cylinder, α - brush Ox angle of inclination to the axis, $\chi(z)$ - Dirac function.

Equation (31) is unknown ρ, p, ϑ and pressure p_1 and p_2 includes. Density to close Eq ρ and pressure p we use the relationship between and also the law of conservation of mass in stationary flow[10-12].

$$\rho = \rho_0[1 + A(p - p_0)] , \; \rho \cdot \vartheta \cdot b = \rho_0 \cdot \vartheta_0 \cdot b_0 = Q_0 \quad (1)$$

in this $\rho_0 = \rho(l)$, $p_0 = p(l)$, $\vartheta_0 = \vartheta(l)$ and $b_0 = b(l)$, A - the compatibility coefficient of the tool, Q_0 - product consumption, l - the length of the cleaning zone.

(1) subtracting the velocities from Eq., we construct one equation to determine the pressure, $p = p(x)$

$$\frac{dp}{dx} + p \cdot F_0(x) = p_0 \cdot F_1(x) + F_2(x) \cdot [p_1 \cdot \chi \cdot (x_1 - x) + p_2 \cdot \chi \cdot (x_2 - x)] 32$$

in this $F_0 = -\dfrac{(c-k)\cdot b^2 - \lambda\cdot k\cdot b_0^2}{b\cdot(b^2-\lambda\cdot b_0^2)}$, $F_1 = \dfrac{\lambda\cdot k\cdot b_0^2}{b\cdot(b^2-\lambda\cdot b_0^2)}$, $F_2 = \dfrac{S\cdot b}{L\cdot(b^2-\lambda\cdot b_0^2)}$,
$\lambda = A\cdot\rho_0\cdot\vartheta_0^2$

(1) is the solution of Eq $p(l) = p_0$ can be in the following form

$$p = \frac{1}{N(x)}\left\{p_0 - p_0\int_x^l F_1(x)N(x)dx - p_2F_2(x_2)N(x_2) - p_1F_2(x_1)N(x_1)\right\}, 0 < x < x_1 \text{ when}$$

$$p = \frac{1}{N(x)}\left\{p_0 - p_0\int_x^l F_1(x)N(x)dx - p_2F_2(x_2)N(x_2)\right\}, x_1 < x < l \text{ when}$$

$$N(x) = e^{-\int_0^x F_0(x)dx}$$

At the points where the saws are located, the pressure assumes the following values, $p(x_2-0) = p_2$, $p(x_1-0) = p_1$

Of these conditions p_1 and p_2 we find the values:

$$p_2 = \frac{p_0}{1+F_2(x_2)}\left\{1-\int_{x_2}^l F_1(x)N(x)dx\right\},\ p_1 = \frac{p_0}{1+F_2(x_1)}\left\{1-\int_{x_1}^l F_1(x)N(x)dx\right\}$$

Fig. 2 is variable x from p/p_0 graphical dependence of the pressure relationship is shown, in which calculations $\rho_0 = 12kg/m^3$, $f = 0.3$, $k = 0.6$, $b_1 = 0.05$, $\alpha = 40^0$, $A = 0.0005\,Pa^{-1}$, $Q_0 = 400kg/s$ accepted. The radius of the shape of the sawtooth gear $R_0 = 0.006m$ and height $l_0 = 0.09m$ taken in the form of a cylinder. To determine the pressure generated by the first sawtooth gasket in the section, the fiber mass filling this section m_1 and its known size $V_1 = L\cdot h_1\cdot c_1$ - we determine experimentally (h_1 - brush height at the entrance to the cleaning section, c_1 -section width). Accepted in accounts $m_1 = 0.054kg$, $h_1 = 0.115m$, $c_1 = 0.07m$, then $\rho_1 = m_1/V_1 = 11.15kg/m^3$

From the graph presented in Fig. 2 $x = 0.07m$ when $p_1/p_0 = 1.4$ we define . Then the following follows from formula (1). $p_0 = 139\,Pa$.

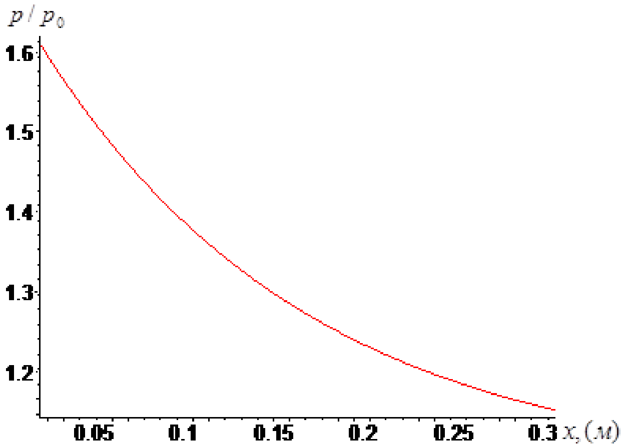

Figure 2. Variable in the smoothing zone x with p/p_0 relational dependence.

We determine the mass of fiber in the second saw cylinder in the leveling zone:

in this $c_2 = 0.06m$, $h_2 = 0.09m$, $x = 0.124m$ we accept. Density in this section using formula (1). $\rho_2 = \rho_0[1 + A(p_2 - p_0)] = 11.7kg/m^3$ constitutes From picture 2 $x = 0.124$ when $p_2/p_0 = 1.25$ we define [13-14].

Summary. From the results of the previous work on fiber cleaners and the research conducted in production, it is necessary to create a fiber cleaner with an improved construction in the production of quality fiber that meets the requirements of the state standard from difficult-to-clean selected cotton selected by hand and machine. To do this, it is necessary to apply a guide device to the production in order to prevent the binding of the brush, to evenly distribute the good elasticity of the fiber to the saw cylinder.

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