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DEVELOPMENT OF A RESOURCE-EFFICIENT DESIGN OF THE RAW COTTON DRYING CYLINDER

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The article examines the shortcomings of the cylinder used in the drying of raw cotton and makes recommendations for improving the design of the cylinder blade. The movement of raw cotton along the cylinder was also studied. There is also a diagram of the forces acting on the raw cotton falling from the cylinder. The article provides important recommendations for the effective use of the cylinder working area.

INTRODUCTON

In our country, comprehensive measures are being taken to ensure the competitiveness of textile products in the domestic and foreign markets on the basis of modernization of ginneries, which are the main raw material for textile clusters that deeply process raw materials and produce more competitive quality products. The President of the Republic of Uzbekistan has set important tasks for the development of the sector and attracting investments.

One of the important issues in fulfilling this task is the creation and introduction into production of effective drying technology in the preparation of raw cotton for cleaning and ginning. In addition, one of the important tasks at each stage of the initial processing of cotton, including its storage and drying, is to identify and eliminate factors that adversely affect the natural properties of cotton products, create and improve energy-saving cotton drying technologies to reduce material and energy costs. [1].

It is known that the export of competitive products from the world market is one of the most important tasks today. Of course, the chances of getting a quality product from quality raw materials will increase even more. Therefore, the purpose of this research is to create a resource-efficient drying equipment and scientifically substantiate its technological parameters, methods of calculating and saving energy consumption in the drying cylinder, technological and economic evaluation of the improved drying cylinder.

One of the main technological processes in the primary processing of raw cotton is the drying process of cotton. The production of modern and high-quality products from cotton fiber is now widely introduced. In order to obtain such products from cotton fiber, it is first necessary to sufficiently dry the raw cotton. Significant results have been obtained by many scientists in the field of scientific research. Therefore, improving the quality of cotton fiber is achieved by improving the drying process of raw cotton. This is due to the fact that the drying equipment used in ginneries does not meet modern requirements, energy consumption is very high, the efficiency of drying raw materials is low, the cylinder is not filled with raw cotton, and the efficiency is insufficient [2,3]. .

MATERIALS AND METHODS

It is known that the inside of the cylinder is equipped with paddles, which ensure a uniform distribution of raw cotton on the surface of the cylinder as the cylinder rotates.

The paddles ensure that the raw cotton is used efficiently from the entire internal volume of the cylinder and that the raw cotton is in the paddles and in the drop zones for the allotted time.

The raw cotton is divided into 3 zones on the surface of the cross section of the cylinder (inside) by its movement (Fig. 1): on the pile and on the spools; when descending; the part not filled with raw cotton.

The duration of stay in these zones varies depending on the cylinder design of the raw cotton and the device of the lifting paddles. Heat and mass transfer in the assembly zone and on the spools is minimal between the drying agent and the raw cotton, but the temperature and humidity begin to spread evenly between the components of the raw cotton. The raw cotton is rapidly heated by hot air in the landing zone. The amount of heat consumed in the area where the raw cotton falls is 70% of the material, and the heat exchange on the surface of the material is 70 times more efficient than on the paddles.

Every minute in the drying cylinder, part of the raw cotton falls on the shovels, another part is poured into the pile,

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and the third is poured from the shovels. The number of shovels on which the raw cotton falls is determined by the following ratio:

$$Z_t = Z_{um}\frac{\varphi_t - \varphi_b}{360}$$

where: Z_{um} - the total number of paddles in the dryer;

φ_t, φ_b - the initial and subsequent angle of spillage of raw cotton; the angle of descent from the paddle (the falling raw material moves to fill the cross section of the cylinder).

As the cylinder spins, the raw cotton spills out of the spoons. The smaller their size, the faster the heat and mass exchange of the raw cotton with the drying agent. In order for the raw cotton to spread evenly across the cross section of the dryers, the pile falling from the paddle must be poured at a distance S from the center of the cylinder, with the paddle falling down [4,5].

Here the cylinder speed should be n = 10 rpm:

$$C = \frac{1}{4}\ (D - 2h_k)$$

The angle of inclination of the ball from the radial direction also causes the last piece of raw cotton to fall. In this case n = 10 rpm, a = 50. The uniform flow of raw cotton in the landing zone depends on the number and height of paddles.

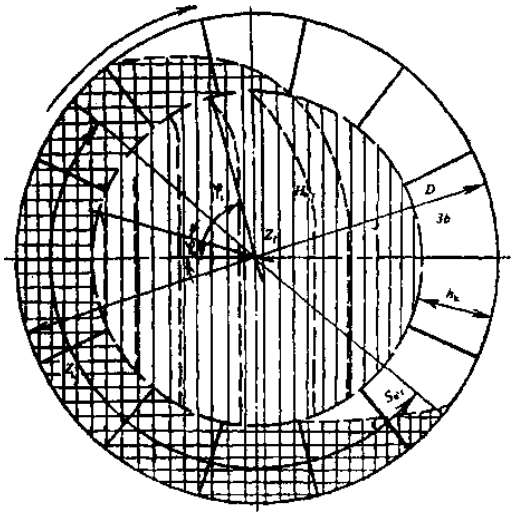

Figure 1. Scheme of movement of raw cotton in the process of rotation of the drying cylinder type 2SB-10.

where: h_k is the height of the paddle

The larger the number of paddles, the smaller the balls of raw cotton fall into the landing zone, which provides a greater amount of heat exchange. When choosing the number of blades, keep in mind that if the distance between them is too short, you will create gaps that cannot be filled. The choice of the number of paddles also depends on the diameter of the cylinder. As the diameter increases, the number of blades increases accordingly [6].

In practice, the drying of raw cotton assumes the following ratio:

$$Z:D = 3{,}5 - 4,$$

where: D - cylinder diameter, m; Z is the number of paddles.

In addition to the drying mode, the height of the spoons also affects the drying quality of the raw cotton. It also depends on the rise of raw cotton from the zone of accumulation.

If the spools do not reach the required height, a rotating cotton roller is formed in the cylinder, and the fibers of the raw cotton are intertwined, which increases the number of defects during cleaning and grinding. It is not rational to eliminate this situation by increasing the number of rotations, because the uniform distribution of raw cotton is disrupted.

Excessive height of the spools increases the useless zone of the cylinder, thus wasting heat, because the heat passing through this zone does not evaporate the moisture of the raw cotton.

RESULTS AND DISCUSSION

It's time for the raw cotton to be in the cylinder

The movement of the raw cotton along the drying cylinder depends on the diameter, length, slope of the cylinder, the speed of the drying agent, the size of the paddles and the work efficiency.

The distribution of raw cotton along the cylinder depends on the shape of the paddles, the amount of cotton that falls on the paddles, the height of the paddle, and the effect of the drying agent.

Since the cotton moving in the cylinder dryer has different shapes, it moves to different lengths along the length of the cylinder depending on the drop height ($\Delta L_1, \Delta L_2$; ΔL_n, and so on) (Figure 2). Therefore, the time of presence of cotton

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in cylinder dryers varies, and its quantity is subject to the law of normal distribution.

The cylinder time of the raw cotton can be determined by heat and mass transfer and the differential equation of particle dynamics.

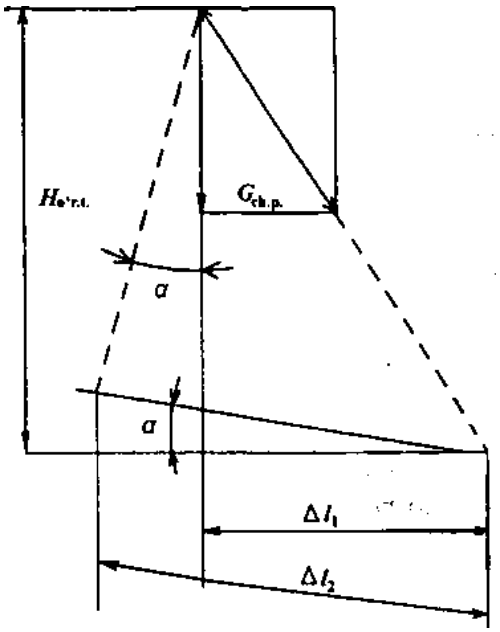
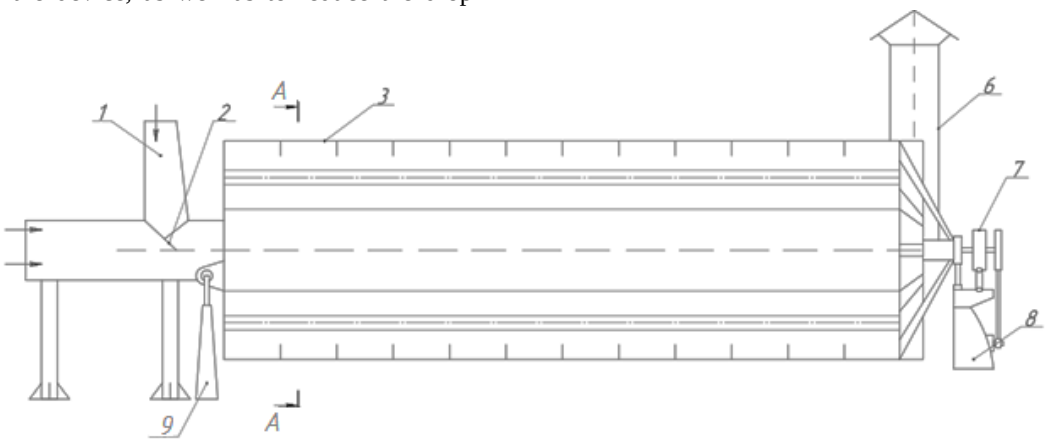


Figure 2. Schematic of the forces acting on the raw cotton in the pile falling from the cylinder

In existing direct-flow dryers, the cotton moves so fast along the cylinder at a speed of 1.5 m / s that the movement of the cotton has to be stopped. One of the main methods of stopping is to reduce the speed of the heat carrier and the stopping guide of the device, as well as to reduce the drop height of the seed cotton [7].

The structure of the recommended drying cylinder is the same as the existing cylinder, made of metal sheet with a diameter of 3200 mm and a length of 10000 mm (Figure 3).



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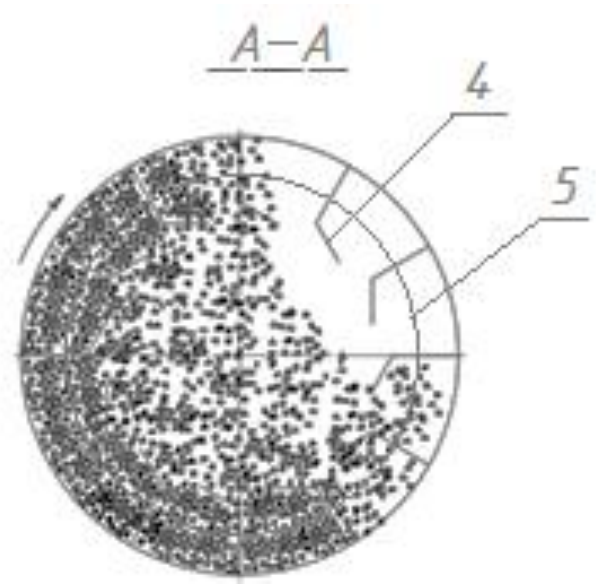

Figure 3. Schematic of the recommended drying cylinder

1st entrance to the raw cotton, 2nd blinds, 3 cylinders, 4 longitudinal shovels, 5 cross shovels, 6 pipes, 7 reducers, 8 and 9 back and front supports .

Inside the cylinder there are 12 shovels along its length, which serve to lift the raw cotton and distribute it according to the size of the cylinder. Each meter of the cylinder is equipped with transverse blades with a height of 250 mm. In the proposed drying cylinder, 1/3 of the length of the shovels is inclined at a certain angle. The main purpose of this is to throw the raw material inside the cylinder at a greater distance, thereby increasing the size of the working area of the cylinder.

CONCLUSION

The design of the proposed paddle is designed to make efficient use of raw cotton from the entire internal volume of the cylinder. It also allows the raw cotton to stay in the paddles longer and expand the drop zones.

The operation of the cylinder is as follows: the drying agent is also transferred to the cylinder from the place where the wet cotton raw material is transferred to the cylinder through the blind supply (2). The raw cotton is raised with the help of shovels, and as it descends from the top, a drying agent passes between them. In this process, the drying agent transfers heat to the wet raw material, absorbs the moisture and releases it to the atmosphere through an exhaust pipe. The raw cotton comes out of the cylinder after several rises and falls and after drying to a certain extent. In this case, the raw cotton is removed using shovels installed at the end of the cylinder.

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