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ANALYSIS OF SOME INDICATORS IN A CONVEYOR BELT DRYER

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Abstract: The scientific significance of the results of the research is that the formulas for calculating the main parameters of the infrared drying device have been obtained, the laws of drying cotton raw materials have been developed, the links showing the heat exchange processes between radiation and raw materials, the possibility of accelerating the drying of cotton raw materials even at low temperature heating has been created as a result of the acceleration of the mass exchange of infrared radiation based on functional ceramics.

Keywords: infrared drying, functional ceramics, radiation spectrum, dry cotton, conveyor belt.

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Introduction

The longer the exposure time t is, the higher the drying efficiency, and the lower the drying efficiency. The height h of the cotton layer on the tape has a negative effect on the drying efficiency, that is, if the height is high, the efficiency is low, and vice versa, it is high. Therefore, it is important to control the exposure time t and the height h of the cotton layer on the tape in the new drying method. In the proposed equipment, the time of cotton in the dryer can be controlled by the speed of the belt. That is, if the speed is greater, the cotton stays in the dryer for less time, and if it is the opposite, it will be longer. This can be done by controlling the conveyor belt drive through an inverter. However, it is required to provide the required height of the cotton layer mechanically.

Material and Methods

Also, when cotton is stored in bales, its density increases to 350 g/m^3, and when the bale is broken and transferred to cotton production, it is in the form of large and small balls, and the density of this mass is high. This situation further increases the unevenness of cotton transfer. The uneven transfer of cotton increases the unevenness of its transfer to the dryer. As a result, cotton does not dry evenly. This has been proven by practical studies. Keeping the necessary height of the cotton layer unchanged within a unit of time ensures uniform drying of the cotton mass in all layers in the new dryer. We will consider the possibilities of ensuring the necessary height of the cotton layer. To solve this problem constructively: - it is necessary to ensure that the cotton does not slip on the tape. This can be solved by installing slats on the conveyor belt. - to tighten the cotton to the maximum and to install a device, i.e., a fixer, which ensures a layer of cotton of the required height on the tape. The drum squeezes the cotton and provides the required height of the cotton layer. The scheme of a technical solution that can perform these tasks is presented in Figure-1.

The Second Level Headings

The device that ensures the required height of the cotton layer works as follows: the cotton moving on the tape 1, which is pulled on the roller 2, is pushed by the piled drum 5 and passes to the required height h. to ensure the height h, the screw adjuster 4 is fixed to the column 3 by means of a hinge, and the drum 5 is movably mounted on the general support 6.

To change the height h, the lever of the screw adjuster 4 is turned, so that the drum 5 is raised (or lowered) together with the main shaft 6. As a result, the distance between the tape and the pile drum increases (or decreases). When the height h increases, the dryer performance increases, but the drying efficiency decreases. When h decreases, the productivity decreases and the drying efficiency increases. It is also possible to control the dryer performance and drying efficiency by keeping the height h constant and increasing or decreasing the belt speed [1].

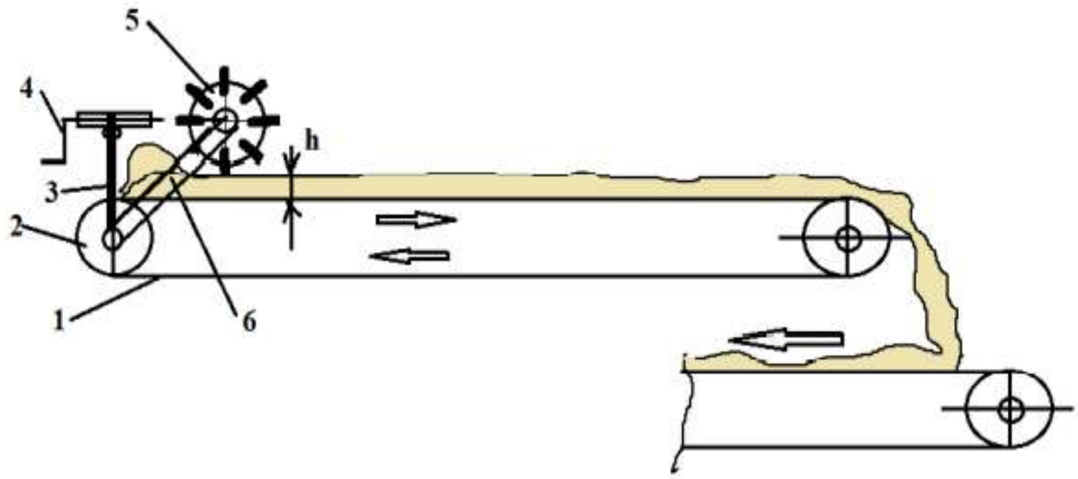

Figure 1. A device that ensures the required height of the cotton layer. tape 1; 2-valik; 3rd column; 4-screw adjuster; 5-pile drum; 6th round support.

Now, let's analyze the process theoretically. The cotton is moving without friction and the total amount of cotton entering and leaving the device is:

$$Q_{in} = Q_{out} \qquad (1)$$

Pile drum n smoothness flatten the cotton pad and tighten it. Part of the cotton lint is returned, and the rest goes to the drying zone in the drum zone. In this case, the cotton layer is divided into 2: transmissive and reversible layers. Let's consider the process of relative movement of cotton layers. We assume that the leveling body is located along the vertical x-axis (Fig. 2).

The two pieces of cotton move in opposite directions with respect to the x-axis. Let the total height of the layer be h. We assume that the movement of the layers is based on the law of linear coupling with respect to the x-axis. Let the speed of the upper layer be Uyu and that of the lower layer be Uo. We write the equation of the relative displacement of the cotton layers at the leveling point:

$$\mu \frac{\partial^2 y}{\partial x^2} = y \frac{\partial^2 y}{\partial t^2} \qquad (2)$$

where: μ- shear modulus; γ- cotton density; u - displacement; t is time. is zero:

$$\mu \frac{\partial^2 y}{\partial x^2} = 0 \qquad (3)$$

(3.) twice, we find the linear displacement q:

$$y = c_1 x + c_2 \qquad (4)$$

integration constants c_1 and c_2 from the initial conditions $x = 0$ if $x = c_2 + U_{yt}$ there is, and $x = h$ if there is $y = -U_{ot}$.

In that case $-U_{yt} = U_{ot} + c_1 h$ from this $c_1 = -(U_{yt} + U_{ot})t \cdot h$ (5)

Putting the findings, we determine the following equation of displacement:

$$y = \frac{(U_{ot} + U_{yt})x}{h} t + U_{yt} \qquad (5)$$

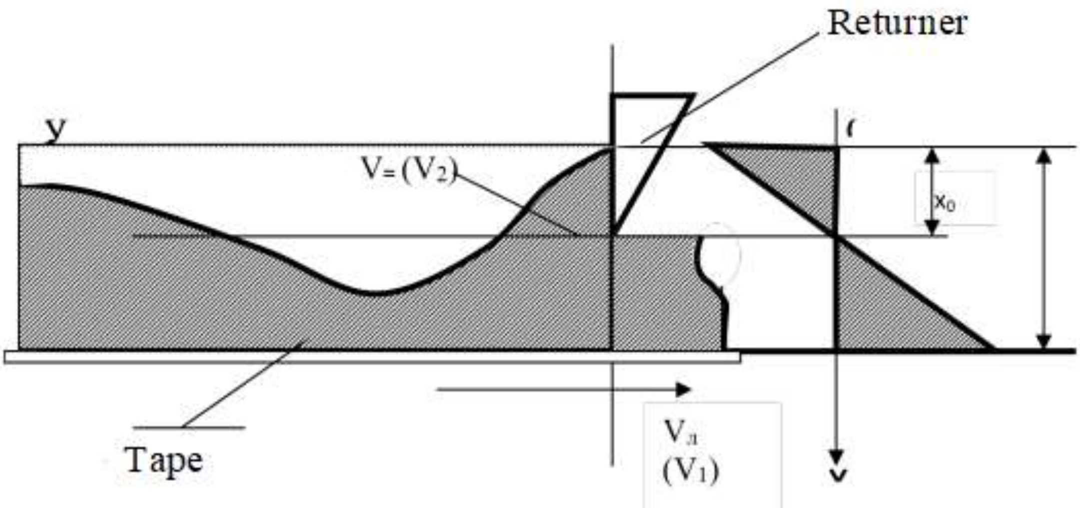

Figure 2. Scheme of the cotton flattening process

The equation of the relative velocity of Q particles can be derived by differentiating (5):

$$U = \frac{dy}{dt} = -\frac{(U_{ot} + U_{yt})x}{h} + V_2 \qquad (6)$$

The main characteristic h of smoothing is the transfer and return capability h, which are found as follows:

$$q = by\int_{x}^{x_n} Udx \qquad (7)$$

b where: b is the width of cotton; x, x_n - coordinates determining the height γ of the cotton pad; - cotton density. limits of integration to determine the ability to return q are x=0; x_n=x is equal to 0. Here: x_0 is the conditional height of the return cotton. x_0 from the condition y=0:

$$-\frac{(U_{ot}+U_{yt})x_0}{h}+V_2=0 \text{ from } x_0=\frac{U_{yt}h}{U_{ot}+U_{yt}} \qquad (8)$$

In that case, the amount of returned cotton is equal to:

$$q = by\int_{a}^{x_0} (-(U_{ot}+U_{yt})\frac{x}{h}+U_{ot})dx=\frac{0.5byhU_{yt}^2}{(U_{ot}+U_{yt})} \qquad (9)$$

The transfer capability of the rectifier is equal to the following:

$$q = by\int_{x_0}^{h}\left(V_2-\frac{(U_{ot}+U_{yt}}{h}\right)dx=-\frac{0.5byhU_{ot}^2}{(U_{ot}+U_{yt})} \qquad (10)$$

minus sign indicates that the direction of cotton release is in the opposite direction to the accepted coordinate axis. Therefore, if the sign h does not count, it will be h am. Accordingly, the equation for the transfer capability q of the rectifier is as follows:

$$q=\frac{0.5byhU_{ot}^2}{(U_{ot}+U_{yt})} \qquad (11)$$

The ability to repeat $q=\frac{0.5byhU_{yt}^2}{(U_{ot}+U_{yt})}$ (12)

The obtained results show that the transfer ability q of the leveler depends on the speed h of the tape, and the return ability q depends on the linear speed of the leveling body. speeds of the operating modes of the provider based on the required values of transmission [2-3]. The performance of the belt device depends on the width of the belt, its coefficient of use of the unit surface, the linear speed of the belt, and the moisture and density of the layer of material moving on it. The supplier we are designing is located at the beginning of the technological chain of primary processing of cotton, and its performance determines the performance of the entire technological chain. Therefore, it is important to calculate the performance of the new supplier. Based on the above, the supplier's cotton transfer efficiency equation can be expressed as follows: $U = kv_tVhy$.

Here: v_t – tape speed, m/s; V – tape width, m; h – height of passing cotton layer, m; k x is the coefficient of use of the tape surface; γ -cotton layer density, kg/s^3.

According to the available data, the speed of the tape v 1 =0.1-3 m/s; tape width V=0.6 m; density of the cotton layer γ=15-25 kg/m^3. According to the studies carried out so far, the coefficient of use of the surface of the tape is around k=0.8-0.9. The height of the passing cotton layer depends on the distance between the outer circumference of the leveling drum and the tape. this interval as h = 150 мм, we can find the required belt speed or, if we take the belt speed, for example, 0.2 m/s, we can find the required layer thickness. However, the force of contact between the q ants installed on the surface of the tape and the drum plates with the cotton pad q is reduced by the ratio h.

Results. Depending on the results of practical studies, we accept this height as h = 0.2 m. We take the density of the crushed γp ash q = 30 kg/m^3, and the coefficient of use of the tape surface is k= 0.85. Based on the results, we calculate the supplier's cotton transfer efficiency h. The result obtained by H calculation falls within this range, and based on this, it can be said that the dryer is new It meets the rational productivity requirements of modern cotton ginning enterprises. Now, we will analyze the performance of the dryer based on the belt conveyor throughput during the changeover period. The results are presented in table 1 [4-7].

Looking at the results, it can be seen that both factors have a linear effect on dryer performance. In particular, as the belt speed increases, the dryer performance increases. In this case, as the value of the height of the cotton layer increases, the productivity increases with greater intensity. The results are presented graphically in Figures 3 and 4.

Effect of belt speed and layer height on productivity

Table 1.

v_t	h	Y
0.1	0.1/0.2/0.3/0.4	0.153/0.306/0.459/0.612
0.5	0.1/0.2/0.3/0.4	0.765/1.53/2.295/3.06
1.0	0.1/0.2/0.3/0.4	1.53/3.06/4.59/6.12
1.5	0.1/0.2/0.3/0.4	2.295/4.59/6.88/9.18

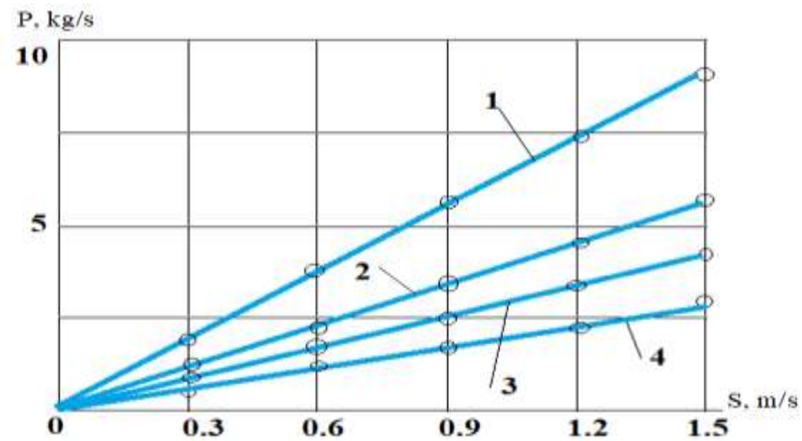

Figure 3. Effect of belt speed on dryer performance

Similarly, as the value of cotton bed height increases, the dryer efficiency increases, and the increase in efficiency is more intense as the belt speed increases. Based on the obtained results, it will be possible to ensure the necessary drying efficiency by controlling the dryer's performance through the second parameter, taking one of the belt speeds or the height of the cotton layer as constant. When drying cotton raw materials in a layer under the influence of infrared radiation based on functional ceramics, it is necessary to determine the drying mode, that is, the time required to dry the material's moisture to the specified moisture level, which depends on the height of the cotton raw material layer. Therefore, it is necessary to have raw materials in the dryer for the required time, that is, the length and width of the dryer are derived from this indicator and the specified productivity provided to the process of cleaning and ginning of raw cotton.

Based on the above, there was a need to conduct research to determine the mode of drying cotton raw materials in different layers under the influence of infrared radiation based on functional ceramics [8-9].

In conclusion the following can be said: In the movement of the infrared drying device based on functional ceramics with the help of a conveyor belt, the even construction of the product is ensured.

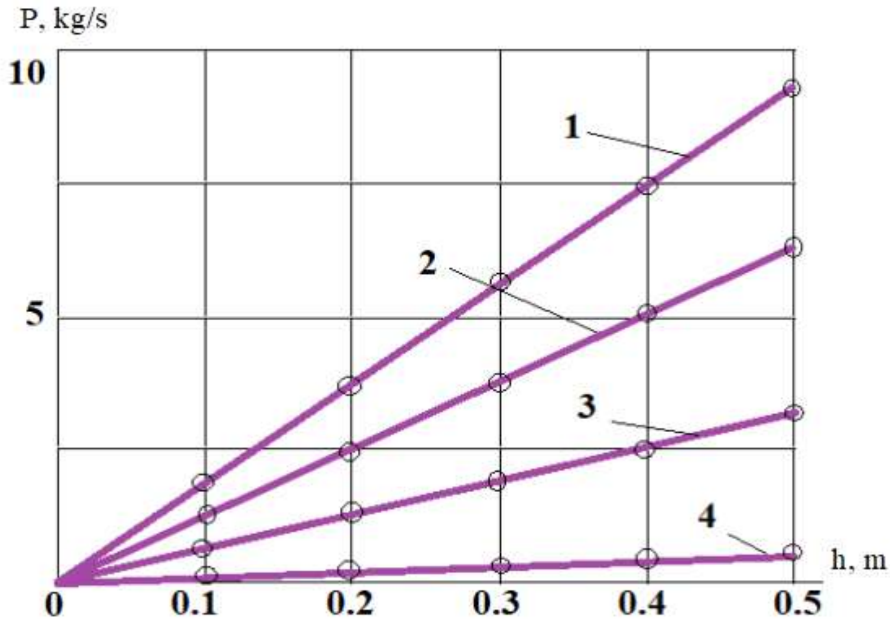

Figure 4. Effect of cotton layer height on dryer performance

The appearance of the product will not be damaged during the construction process. 90 % of the product content is preserved.

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