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Theoretical and Practical Examination of the Process of Transfer of Cotton to the Pipes of the Air-Carrying Device

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ABSTRACT

The article examines the process of air transportation of cotton in ginneries in a theoretical and practical way. At the same time, the operation of the RBX demolition machine was studied.

KEYWORDS: *cotton, rake, pile cutter, air pipe, horizontal belt device, roughness, aerodynamic forces, separator*

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INTRODUCTION

At present, at the beginning of the technological process of ginneries, mechanized transfer of cotton to the pipeline of the air-carrying device system is carried out by means of spinning machines RP, RBA, RBX. The operation of the RBX spinning machine was studied at the Namangan ginnery. The RBX baler breaks the bale using a pile cutter and passes the cotton to a horizontal belt machine. It, in turn, transmits air to the carrier pipe. There is a possibility that the arrow mounted on the pile cutter of the bulldozer will rise and fall to the side [1].

Such an opportunity increases the efficiency of its transmission by breaking the cotton from the husk. The process of transferring cotton from the bale to the baler is carried out in two stages according to the established scheme. In the first, the plow-breaking machine has the ability to move along the length of the pile, breaking up a part of it around 6 meters. In it, the distance between the horizontal tape device and the pile is 5 meters.

In the second stage, the baler will be able to pass the remaining 8 meters across the width of the bale. In this case, the horizontal belt device is installed on the cotton ginning area.

Examining the condition of the cotton being conveyed by the gharam separator, we came to the following conclusion. The milling machine breaks the cotton from the pile with its pegs, passes it to the tape in a ball position, and the cotton is unevenly distributed over the tape. As a result, an uneven transfer of cotton to the air-carrying device pipe occurs. In order to study this situation in detail, a schematic of an experimental device was developed and prepared at Namangan Cotton Ginning Plant No. 3 (Figure 1). This air-carrying device consists of a spool device with a sloping belt device (1) and a horizontal belt device (2) and an air-carrying device (3). The horizontal tape device is mounted along the line of the spoiler.

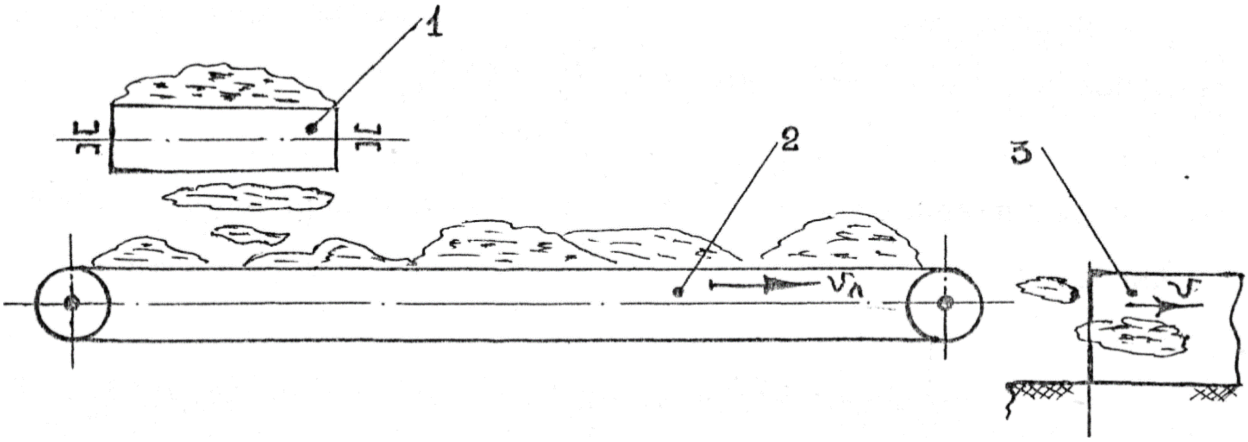

Figure 1 Schematic of an experimental device prepared for the study of unevenness in the transmission of cotton

1-slanted tape device; 2-horizontal tape device; 3-air-carrying cotton tube

The method of the study was as follows: the equipment prepared for the study was conditionally divided into 10 equal sections by the length of the horizontal conveyor, which was installed parallel to the line of displacement. The linear speed of movement, the width and length of the tape, the dimensions of the plots were determined, and scales were prepared for weighing the cotton. The outlet side of the conveyor is designed to transfer the material directly to the pipe. The air-carrying device separator and fan, horizontal conveyor and bulldozer were installed in accordance with the applicable operating rules. During the study, the operation of the baler and separator is regularly monitored, with special attention paid to the process of cotton transfer. After 60 minutes, the spoiler and horizontal tape device were stopped at the same time. This creates a spread of cotton on the surface along the length of the tape. This spread characterizes the state in which the material is being transmitted.

The resulting spread was divided into pieces along the sections marked on the surface of the horizontal tape.

Each piece was weighed and the weight of the cotton was determined separately and without generalization for each piece.

The experiment was repeated 3 times.

The unevenness index was developed according to a special methodology:

$$S = \sqrt{\frac{\sum_{l=1}^{n}(k_i - k_{cp})}{n-1}} \qquad (1)$$

Where: S- is the dispersion of the specific gravity of the material along the surface of the tape; $k = \frac{m}{F_л}$ - Criteria for characterizing the weight of the material corresponding to the relevant section; the weight of the cotton in a given section of *m*-tape; F_l- is the area of the tape section being viewed; number of *n*-plots (*n=10*).

The transmission efficiency of the device is found by the following formula depending on the mass of cotton on the tape:

$$П = 3{,}6\frac{m \cdot V_л}{L} \quad m/c \qquad (2)$$

where: m-is the mass of cotton on the tape, kg; V_l -string speed, m / s; L-is the length of the tape, m.

The results of the study are presented in Table 1.

Table 1 Results of the study of the unevenness of the transmission of cotton to the air-carrying device

Indicators					
Type and variety of cotton	Humidity %	Dimensional density kg/m^3	Production capacity t / h	Specific density variance kg/m^2	Disorders within 1 hour
S6524 II nav hand pick	9,5	66,6	9,7	1,61	1g
	9,5	75,6	9,5	2,33	1g
	9,5	83,4	9,97	2,74	2g, 1s
S6524 II nav machine pick	11,2	69,2	9,2	2,11	2g
	11,2	74,4	9,1	2,62	1g
	11,2	89,7	9,8	3,06	4g, 2s

Note: Column 7 shows the amount of blockages in letters: g-pipe mouth (gorlovina), s-separator chamber.

As can be seen from Table 1, its unevenness is high during cotton transfer. This figure increases with increasing volume density of cotton and high humidity. This is due to the over-compaction of the cotton from the gin. The spinning machine cannot grind the cotton to the required level. Observations have shown that in high roughness, the cotton is placed on the surface of the tape as balls, with a high density and weight, and closes a certain section of the inlet when entering the pipe. If the pieces enter the pipe in this way, a large aerodynamic shadow is formed behind it during transport. The air pressure in this zone is significantly lower, and then the section that falls into the pipe falls to the bottom of the pipe, not receiving the required aerodynamic force. Here, the aerodynamic forces include the resistance force created by the adhesion of cotton to the inner surface of the pipe, which closes the pipe inlet.

During the study, clogging of the cotton in the pipe at low humidity and low bulk density for one hour was observed twice at the inlet, once in the separator chamber. At high humidity and volumetric density - 4 times at the inlet of the pipe, 2 times at the separator chamber.

The negative effects of blockages in the separator chamber are particularly large. Depending on its severity, an average of 25 minutes of production time is required to eliminate blockages in the separator. This can also cause the separator hose to break and require additional time to replace. In addition, when the separator chamber is clogged with cotton, the working chamber of the separators is filled with cotton. This is often overlooked during production. As a result, only a portion of the cotton is absorbed by the air. The rest falls into the stone collection hopper of the quarry.

From the above, it can be concluded that it is necessary to reduce the unevenness in the transmission of cotton. This will increase the productivity of all elements of the air-transport device and the equipment that makes up the technological chain of cotton processing.

It is necessary to develop a theoretical basis for conducting research on an airborne device. This requires a more precise study, which fully reveals the process of collision of cotton with all the working bodies of the air-carrying device. Based on this, it is possible to improve the design of the device elements.

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