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Development Of The Resource-Saving Structure Of The Section Of Small Purification Of Fiber Material

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ABSRACT: The article provides an analysis of the drying structures of the cleaners of fibrous materials from gwaste waste. A new resource-saving design scheme of the cleaning section equipped with conical cylinder beaters is presented. On the basis of comparative tests, the effectiveness of the use of the recommended cleanser design was substantiated.

KEYWORDS: cleaner, fibrous material, grid surface, effect, fiber quality, damage, resource saving.

I.INTRODUCTION

In the well-known design of a cotton-cleaning unit, sections for cleaning cotton from small and large waste are combined [1]. Two saw tooth cylinders are installed under the barrels and under the grate there are forming sections for cleaning raw cotton from waste. In the section of fine cleaning consistently set spiked cylinders and grid surfaces under them.

The main disadvantage of this design is the low effect of cleaning cotton from waste. The total removal of isolated weed impurities, leading to the mixing of small waste selected in the section for fine purification with precipitated large soils and volatiles in the section for coarse treatment. This leads to additional difficulties in the regeneration and re-cleaning of cotton.

In the design of a raw cotton cleaner from small weed impurities 1XK, SCH-2 [1], four identical spiky cylinders with a mesh surface under them in a horizontal plane are successively installed. In this construction, the drainage system is a box or floor, from which the small waste is periodically removed manually. The main disadvantage of the known design is the low effect of cleaning cotton due to the monotonous interaction of the cylinder heads with cotton pickers pulled through the grid surface. In addition, the large dust content of the air due to the lack of aerodynamic removal of small weed impurities (usually in the production of small waste falls to the floor freely in height 700 mm).

In the design, the cleaning unit includes four sequentially installed composite cylinders made with spiky, bars and rubber ring bushings installed between the outer cylinders with spiky, bars and hubs mounted rigidly on the shaft of the cylinders, and the thickness of the rubber ring bushings of each subsequent cylinder with spiky and strips, less by 10-15% than in the previous cylinder (in the course of moving cotton). Under the spiked cylinders, cylinder surfaces are installed, and at the bottom there is a pneumatic strainer for removal of the selected small waste. Each subsequent cylinder with spiky and strips will perform additional torsion vibrations with a higher frequency and a smaller amplitude, resulting in an effective release of waste impurities [2].

The main disadvantage of the existing design is the low effect of cleaning cotton from small debris due to insufficient oscillation of the spiked cylinder due to its large mass (moment of inertia), as well as inhibition of cotton in the transitional zones between spike cylinders due to insufficient linear speed of spikes and slats of the subsequent cylinder. In addition, the monotony of the cotton cleaning process does not allow an increase in the cleaning effect.

In order to increase the cleaning effect of the cleaning section from small waste of a cotton-cleaning unit, the design has been improved through the implementation of spike cylinders with increasing speed patterns for the movement of cotton, as well as by improving the design of spinning cylinders.

The cleaning section of a cotton-cleaning unit includes a body 1, conical cylinders 2 mounted in it horizontally, consisting of a truncated cone 4 with spiky 5 and strips 6, mounted on a shaft 7 by means of a hub 8 and rubber ring bushings 9 (fig. 1). The hub 8 and rubber ring bushings 9 are also made in the shape of a truncated cone, respectively, the tapers of the cylinders 2. The difference in diameters of the bases of the truncated cones of the cylinders 2 is $D_1 - D_2 = (25 \div 30)$ mm, (D_1 is the diameter of the larger base; D_2 is the diameter of the smaller the bases corresponding to

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the size of the cotton blades. In the cotton cleaning zone, each adjacent tapered cylinder 2 is set opposite to the tapers. At the same time, the grid surfaces 3 are also tapered. The rotational speed of each subsequent cylinder 2 chosen more than (10 ÷ 15) rpm than the frequency rotation of the previous cylinder 2.

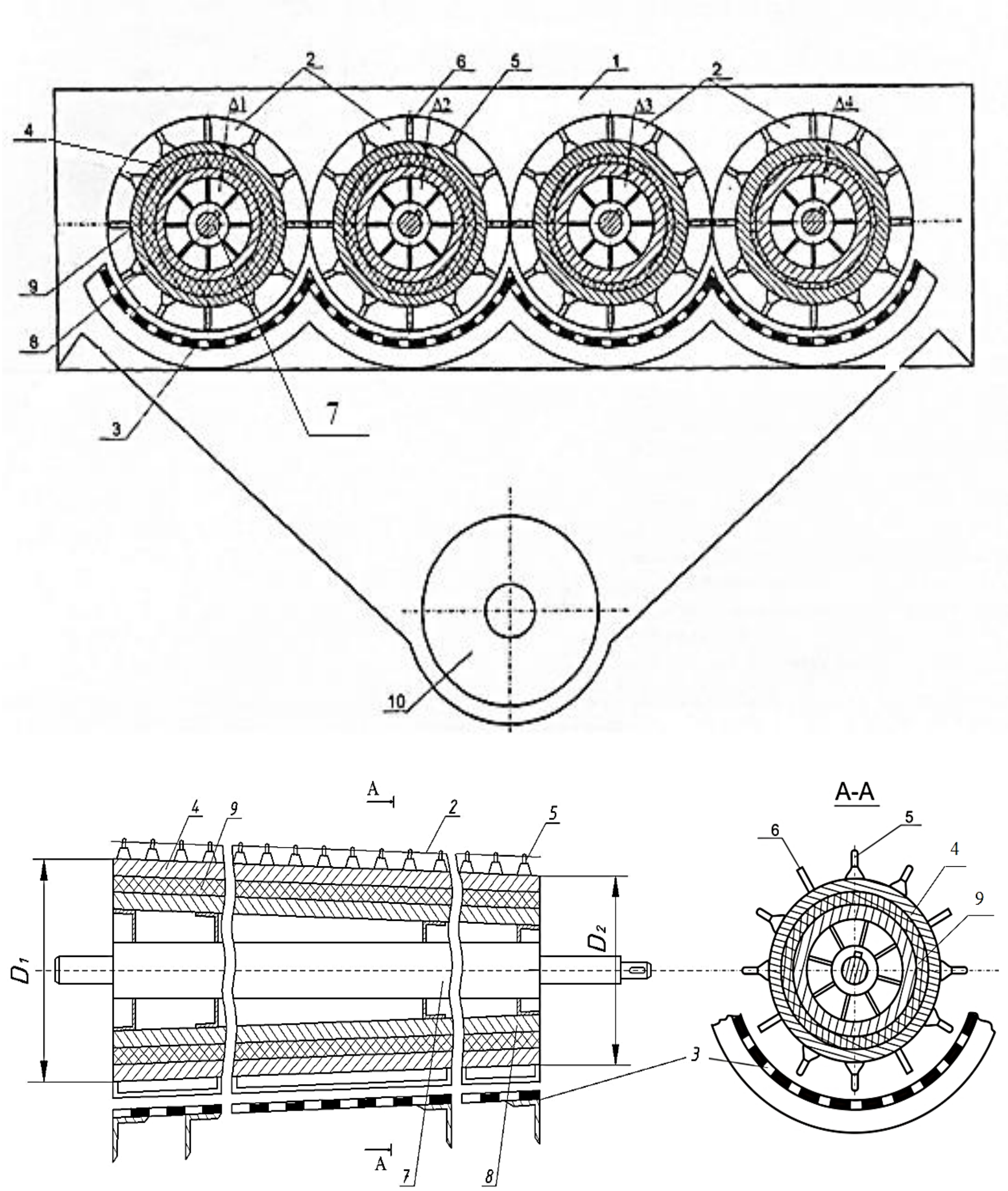

Fig.1 Cleaning section of a cotton-cleaning unit

The cleaning section of the ginning unit operates as follows. A clogged raw cotton, transported in a cotton gin unit (Fig. Shows only one section of the wiper) enters a conical cylinder 2, the pegs 5 and 6 which grasp strips cotton flying detachment and drags them through the grid surface 3. The isolated small waste falls through openings grid surface 3 and further through the pneumatic drainage system are removed from the cleaning zone.

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The frequency of rotation of the conical cylinders 2 is selected increasing along the direction of the flow of cotton, eliminating their inhibition. Conical cylinder 2 with pegs 5 and strips 6 due to the resistance of the dragged cotton makes torsion vibrations. When this rubber ring bushings 9 are deformed, which lead to torsion vibrations of the truncated cone 4, pegs 5 and strips 6.

This leads to an additional impulsive effect of spiky 5 and strips 6 of the conical cylinder 2 on raw cotton, which allows for the intensive release of small weed impurities from raw cotton. Due to the different thickness of the rubber ring bushings 9 conic cylinders 2, spiky 5 and strips 6 oscillate with different amplitude and frequency. The first conical cylinder 2 oscillates with a larger amplitude and lower frequency than the second cylinder 2, and that in turn oscillates with a larger amplitude and lower frequency than the third cylinder 2, and so on. Considering that the thickness of the rubber bushings 9 of the corresponding caustic tapered cylinder 2 numbers 1,2,3,4, each subsequent tapered cylinder 2 will perform torsion vibrations with a smaller amplitude and a higher frequency.

At the same time, cotton clams are exposed first (the first conical cylinder 2 with spiky 5 and strips 6) to vibrations with greater amplitude and lower frequency (less rigidity), which results in the release of debris associated with cotton with a smaller force, and then during the interaction of the second, third and Fourth conical cylinder 2 with spiky 5 and strips 6 with cotton, fluctuations of cotton with a smaller amplitude and greater frequency will occur, weed impurities associated with cotton will be allocated with greater force and located deep in the cotton. In addition, the installation of pneumatic drainage system 10 for the selected raw cotton impurities allows the reduction of air dustiness in the cleaning department of the cotton grower. The tapering of the cylinder 2 when dragging cotton bolls along a conical mesh surface 3 leads to some movement of cotton bats in the transverse direction and these movements will be opposite for each bat when it is pulled over the mesh surface 3 in the cleaning zone of the subsequent conical cylinder 2. At the same time, the path of the bat's movement increases. This allows for additional shaking of the cotton batches and additional release of waste from it.

The proposed design of the cleaning section of a cotton-cleaning unit allows an increase in the cleaning effect of cotton by 10-15%. An opiate sample of the section was produced by a glimpse of the cleaning of the fibrous material of the aggregate. Production tests are righteous in clap factory conditions.

When testing, the recommended conical spiky cylinder in the raw cotton cleaner from fine waste of the 1XK brand showed high reliability and stability of operation. The test results showed that the cleaning effect compared with the existing version of the cylinder barrel provides a more efficient release of weed impurities and eliminates the process of inhibition of cotton. The results of comparative technological tests on production lines of cleaning with serial and experienced designs of sections of cleaning units 1XK are presented in table 1.

Table 1

The results of the comparative technological production tests on the 1st and 2nd cleaning lines 1HK.

Indicators in %	**After upgraded section of the unit in the 1st line 1XK**	**After the serial unit in the 2nd line 1XK**
Humidity (%)	10,1/8,1	10,1/8,1
	9,4/8,4	9,4/8,4
	9,6/8,2	9,6/8,2
Amount of waste (%)	4,8/2,85	4,8/3,2
	4,5/2,75	4,5/3,05
	4,2/2,45	4,2/2,9
After cleaning Cleaningeffect	41,6	33,3
	39,9	32,2
	41,3	30,9

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Note: the experiments were conducted in triplicate. The table shows the average values of indicators.
Analysis of the data in Table 1 shows that the recommended design allows the production of fibrous material, in particular high-quality cotton, the cleaning effect increases by an average of (8.0 ÷ 8.5)%.

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