IMPROVING FIBER QUALITY ON THE BASIS OF IMPROVINGCOTTON DRYING DRUM

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Abstract: The article is devoted to improving the quality of cotton produced by ginners. It has been shown that there is a problem of cleaning and obtaining quality fiber due to the high level of dirt and moisture in the cotton picked on the machine and the fact that the dirt is more strongly bound to the fiber. In the technological processes of the existing ginneries, cleaning equipment is installed that provides the maximum allowable frequency of cleaning, and it is explained that it is not possible to install additional equipment. It has been shown that cotton can be cleaned without additional mechanical action on the fiber, for which cotton can be cleaned in an SBO drying drum, but it is not used in production due to a number of shortcomings.An improved version of the SBO drum has been proposed, which eliminates the shortcomings of this drying drum. Experimental testing of SBO and improved drums was based on the fact that the recommended drum has a high cleaning efficiency, stable performance, the ability to improve the quality class of fiber produced. It was found that the impurities in the passive bond with the fiber are separated, as well as the impurities in the active bond. As a result, a reduction in the amount of fiber deficiencies and impurities was achieved. It was recommended to use an improved drying drum instead of existing dryers.

Keywords. Drying drum, cotton moisture, cotton dirt, small and large dirt, defective impurities and impurities in the fiber, fiber class, cotton cleaners, saw drum, pile drum.

INTRODUCTION

The high content of defective compounds and impurities in the fiber produced at ginneries has a negative impact on the efficiency of technological equipment of spinning mills and the quality of yarn. In recent years, the increase in the volume of cotton picking by machine has further complicated this problem. Due to the high humidity and dirt content of machine-picked cotton, as well as the high strength of the fiber binding, it is more difficult to clean, and the efficiency of cleaning cleaners is insufficient. [1, 2]. As a result, the production of "high" and "good" class fibers from machine-picked cotton is almost non-existent, mainly "medium", "ordinary" and "dirty" class fibers are obtained, which causes great economic losses [3, 4].

By a number of researchers [5, 6, 7] The frequency of cleaning cotton from fine and coarse contaminants has been studied, and in pile drums up to 24 times in pile drums to maintain fiber quality.

Based on the possibility of re-cleaning up to 4 times. Excessive reprocessing leads to a significant decrease in fiber quality.

At present, all ginneries have 4 saw drums and up to 32 pile drums, which do not have the possibility of additional cleaning [8]. Therefore, increasing the efficiency of cotton ginning should be achieved without additional mechanical impact, at the expense of improving cleaning equipment or creating new ones.

As a result of the experiment, regression equations were determined to determine the cleaning efficiency of cotton depending on the initial contamination.

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Cleaning efficiency for hand-picked normal ginned cotton:

$$y = -0{,}021x^2 + 1{,}252x + 78{,}83 \quad (1)$$

For hard-to-clean cotton:

$$y = -0{,}026x^2 + 1{,}2x + 74{,}8 \quad (2)$$

For machine-picked hard cotton:

$$y = -0{,}054x^2 + 2{,}54x + 61{,}35 \quad (3)$$

where x is the initial contamination of the cotton, %. (x=10÷20 %)

The analysis found that the cleaning efficiency under production conditions ranged from 82.7% to 88.7% for manually picked hard-to-clean cotton varieties, depending on the initial contamination of the cotton, and from 78.2% to 91% when machine-picked. This is definitely not enough for some cases. To obtain high-grade fiber, especially "High" and "Good" fiber, it is necessary to increase the cleaning efficiency.

We will determine how much additional cleaning efficiency will be required for high-grade fiber development. We write the formula for determining the cleaning efficiency required for this as follows

$$К_{кер} = [1 - (1 - \frac{К_{ум}}{100})(1 - \frac{К_{куш}}{100})] * 100 \quad (4)$$

where $К_{кер}$ −is the cleaning efficiency we need to get high quality fiber,%. The overall cleaning efficiency of existing ginners installed at the $K_{ум}$ - ginnery is determined using formulas (1), (2), (3), depending on the initial contamination of the cotton.

$K_{куш}$ - additional cleaning efficiency from formula (4).

$$K_{куш} = \frac{K_{кер} - К_{ум}}{1 - 0{,}01К_{ум}} \quad (5)$$

Depending on the contamination standards of the coordinated technology of primary processing of cotton and the initial contamination of cotton, it will be possible to determine the efficiency of additional cleaning using formula (5).

TABLE 1. Calculate the additional cleaning efficiency required to obtain high quality fiber

Cotton sort	Primary contamination of cotton, %	The required cleaning efficiency, %		Actual ginning efficiency of ginneries, %			Cotton contamination in gin tar, %			The additional cleaning efficiency required to obtain “high” and “good” grade fiber, %		
		1	2,3	1	2	3	1	2	3	1	2	3
I	8	81,3	75,0	87,5	82,7	70,1	1	1,4	2,39	10	28,6	58,2
II	8	81,3	75,0	87,5	82,7	70,1	1	1,4	2,39	0	14,3	58,2
I	12	80,0	73,3	90,8	85,4	77,0	1,1	1,8	2,76	10,9	41,4	63,8
II	12	80,0	73,3	90,8	85,4	77,0	1,1	1,8	2,76	10,9	33,3	63,8
I	16	85,0	80,0	93,4	87,4	79,3	1,1	2,0	3,31	10,9	50,0	76,7
II	16	85,0	80,0	93,4	87,4	79,3	1,1	2,0	3,31	9,1	40,0	76,7
I	20	88,0	84,0	95,4	88,4	77,5	0,92	2,32	4,49	0	56,9	77,7
II	20	88,0	84,0	95,4	88,4	77,5	0,92	2,32	4,49	0	44,4	77,7

Note: 1-normally cleaned cotton variety; 2-nd hard-to-clean cotton variety; 3 - for cotton picked on the machine.

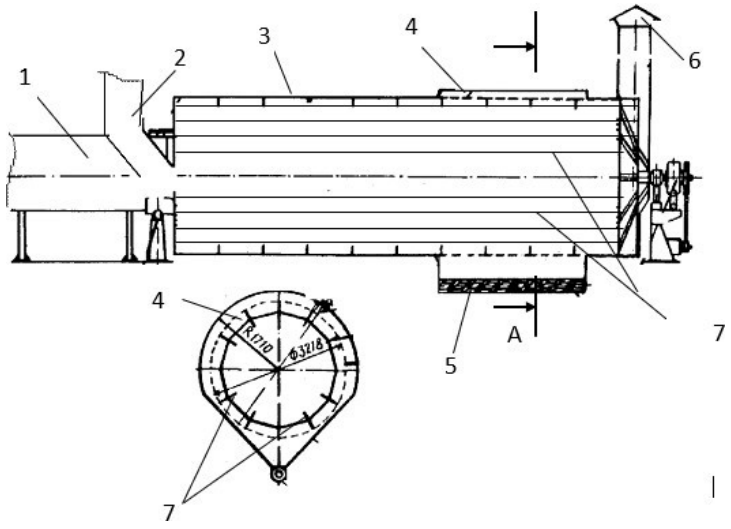
From the data in the table, it is possible to obtain "High" and "Good" fiber from normally cleaned I and II grade cotton, and the efficiency of additional cleaning of cotton from 0 to 10.9%, depending on the initial contamination, it was found that it should be between 14.3% and 60% for high-grade fiber from hard-to-clean cotton.

Obtaining high-grade fiber from machine-picked cotton in the existing technology of ginneries is a complex issue, in addition to this

Requires additional cleaning efficiency of up to 77%. To achieve such efficiency, additional cleaning of cotton requires an increase in fiber cleaning steps.

To solve this problem, a number of researchers [9, 10, 11, 12] recommendations have been developed and various cotton ginning streams have been created. However, they have not been put into practice due to insufficient cleaning efficiency and shortcomings in stable operation.

Researchers [13, 14, 15] proposed the cleaning of cotton on a drying drum, on the basis of which an SBO-authoritative drying drum was developed (Pic. 1).



1 -hot air transmission line; 2- pneumatic suppliers; 3- drying drum; Cleaning section 4; 5- dirt shnegi; 6- used air outlet shaft; 7- blades mounted inside the drum;

FIGURE 1. Technological scheme of SBO drying drum

The length of the drying drum is 10 meters, it is mounted on a mesh surface at 6-9 meters and covered with an additional shell. At the bottom of the mesh surface, a dirt screw is installed to remove any contaminants. As a result of the use of the SBO drying drum in ginneries, it was found to have a number of shortcomings. In particular, in case of fire, the cotton wool sticks to the mesh surface and dirt auger, which is difficult to clean and time consuming [16].

Taking into account the shortcomings noted by us, the drying drum SBO was improved and the SBO-M drum was created.

OBJECT OF RESEARCH

The cotton drying drum is an SBO, the main purpose of which is to increase the efficiency of the cleaning process by eliminating its existing shortcomings.

The difference between an advanced drying drum and an SBO dryer is as follows:

• the dirt screw has been removed. An air chamber is installed on the surface of the net to remove the separated contaminants, and air suction pipes and a fan and a stone holder are installed on its side. A rubber squeegee is mounted on the drum surface to transfer contaminants released from the mesh surface to the pipe.

• drum blades and cotton gins on the mesh surface are equipped with pegs with a height of 25 cm, a diameter of 2.5 cm and a distance of 30 cm. They serve to crush the cotton that falls from the shovels.

The cotton part of the drum was replaced with a mesh surface, on which the paddles were mounted pegs with a diameter of 2.5 cm, height 15 cm and a distance of 15 cm.

A comparative experiment was performed with the recommended drying drum SBO drum.

METHODOLOGY OF EXPERIMENTS

The improved drying drum was prepared SBO-M and installed side by side with SBO. Moisture 9.16%, pollution 6.72% S65-24 II grade cotton batch was taken and dried on SBO and SBO-M drums in turn and cleaned in 1XK - UXK (3 sections) -1XK cleaners and separated by fiber in 5DP-130 gin equipment and the fiber was cleaned in a 1VPU cleaner. Drying temperature was 90 0S, working productivity was 7.5 t / s. After each process equipment, samples of cotton and fiber were taken to determine their contamination, moisture, and the amount of contaminants and defective impurities in the fiber.

EXPERIMENTAL RESULTS AND THEIR ANALYSIS

The experimental results are presented in Tables 2 and 3.

TABLE 2. Results of cleaning of dried cotton in SBO drum in technological processes

Number	Cotton indicators	Repetition of experience	Cotton pollution %			Cleaning efficiency %		
			small	large	general	small	large	General %
1	windrow	1	5,65	1,30	6,95			
2		2	5,01	1,4	6,41			
3		3	5,15	1,65	6,80			
4		middle	5,27	1,45	6,72			
5	After the drum	1	4,52	1,24	5,76	20,00	4,8	17,13
6		2	4,08	1,34	5,42	18,56	4,4	15,40
7		3	4,00	1,58	5,58	22,33	4,0	17,87
8		middle	4,20	1,39	5,59	20,30	4,4	16,80
9	In the genius	1	0,88	0,31	1,19	80,53	75,00	79,30
10		2	1,01	0,29	1,30	75,25	78,10	76,10
11		3	0,88	0,38	1,26	78,0	75,20	77,40
12		middle	0,92	0,33	1,25	78,1	76,10	77,60
13	Overall cleaning efficiency,%	1				84,42	76,15	82,88
14		2				79,84	79,29	79,72
15		3				82,91	76,97	81,47
16		middle				82,54	77,24	81,70
17	Contamination and defective compounds in the fiber	1	2,7					
		2	2,45					
		3	2,5					
		middle	2,55					

TABLE 3. Results of cleaning of dried cotton in SBO-M drum in technological processes

№r	Cotton indicators	Repetition of experience	Cotton pollution %			Cleaning efficiency %		
			small	large	умумий	small	large	General %
1	windrow	1	5,65	1,30	6,95			
2		2	5,01	1,4	6,41			
3		3	5.15	1,65	6,80			
4		ўрта	5,27	1,45	6,72			
5	After the drum	1	3,70	1,08	4,78	34,6	16,59	31,2
6		2	3,35	1,15	4,5	33,2	18,01	29,8
7		3	3,39	1,37	4,76	34,1	17,12	30,0
8		ўрта	3,48	1,20	4,68	33,97	17,24	30,36
9	In the genius	1	0,57	0,094	0,664	84,59	91,30	86,11
10		2	0,54	0,090	0,630	83,88	92,19	86,00
11		3	0,58	0,082	0,662	82,89	94,01	86,09
12		ўрта	0,56	0,090	0,650	83,91	92,50	86,07
13	Overall cleaning efficiency,%	1				88,30	94,8	90,45
14		2				89,21	94.16	90,17
15		3				90,60	92,41	90,26
16		ўрта				89,37	93,79	90,33
17	Contamination and defective compounds in the fiber	1	2,43					
		2	2,37					
		3	2,28					
		ўрта	2,36					

When cotton is dried and cleaned in the SBO drum (Table 1), its initial contamination is 6.72% (5.27% for minor contamination, 1.45% for coarse contamination) and 5.59%, 4.20%, respectively, after the drum. and 1.39%. The cleaning efficiency of the SBO drum was 16.8% overall, 20.3% for minor impurities and 4.4% for large impurities.

The total contamination after the flow of cotton ginners was 1.25% (0.92% for minor contamination, 0.33% for coarse contamination) and the cleaning efficiency was 77.6%, 78.1%, 76.1%, respectively, compared to the contamination after the cotton drum. %. The total cleaning efficiency of the technological flow obtained in relation to the initial contamination of cotton was 81% (82.54% for minor contamination, 77.24% for large contamination). The amount of impurities and impurities in the fiber produced was 2.55%, which was classified as “good”.

When cotton was dried and cleaned in the SBO-M drum, its impurity was 4.68% (small 3.48%, large 1.2%) and the cleaning efficiency was 30.36%, 33.97% and 17.24%, respectively. Contamination of cotton after the flow of ginners is 0.65% (small 0.56%, large 0.09%), the efficiency of cleaning ginners is 89.7% (83.91% for small contamination, 92 for large contamination) compared to the post-drum contamination of cotton. , 5%).

When calculating the primary contamination of cotton, the cleaning efficiency was 90.33% (89.37% for minor contamination, 93.79% for large contamination). Defective impurities and impurities in the fiber were 2.36%, corresponding to the "high" class.

The results show that the cleaning efficiency of cotton in SBO-M is 13.56% higher than in SBO, the amount of defective impurities and impurities in the produced fiber is 0.19% less, and the fiber class has changed from "good" to "high".

As can be seen from Tables 2 and 3, the difference in the cleaning efficiency of the drying drums was 13.56%, while the difference in the cleaning efficiency after the cleaners fell to 8.63%.

This is due to the fact that the drying drum mainly releases passive contaminants with low fiber binding strength. The difference has been reduced due to the fact that these contaminants are also cleaned in the cleaners. The difference in cleaning efficiency of 8.63% indicates the release of impurities with high fiber binding strength along with passive impurities, as well as the efficiency of the SBO-M drying drum.

The improved drying drum operated stably during the SBO-M test, with no defects in the working elements.

In conclusion, the improved drying drum SBO-M has a significant advantage in terms of cleaning efficiency of cotton from existing 2SB-10 and SBO drums, and its introduction into production allows to improve the fiber quality.

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