

RESEARCH ON IMPROVED 6A-12M SCREW CONVEYOR PILES

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Abstract. *The article presents the results of research conducted on the 6A-12M equipment with improved screw conveyor piles. The research was carried out in the equipment for removing small impurities installed at the Rishton cotton ginning enterprise. In the technological process, an improved version of the screw conveyor was installed in the lower row of the 1st section of the 2nd 6A-12M cleaning equipment. It is possible to make a comparison on the whole equipment or on sections. According to the results of the research, it was found that the efficiency of cleaning from small impurities is 6% higher than the existing version of the 6A-12M equipment.*

Introduction. With the transition of cotton ginning enterprises to the cluster system, the improvement of techniques and technologies, the creation of new working equipment, and the production of electricity and energy-saving technologies have become an urgent problem.

To remove fine impurities, pile drums, and screw conveyors with mesh surfaces or ribs are used [1]. Although many studies have been conducted by domestic and foreign scientists on the improvement of these working units, based on the analysis of the literature, we can see that there are reserves for their improvement [2].

In the middle of the 20th century, the Fergana cotton ginning enterprise installed piles at the ends of the screw conveyor used to transport cotton and a cleaning rib underneath to clean the cotton from small impurities. Based on this design, the 6A-12 type cleaning equipment was created and was widely introduced into all cotton ginning enterprises of the republic in those years [3].

The 6A-12M type screw cleaning equipment (see Figure 1) consists of two parallel identical sections, each section consisting of independent upper (1) and lower (2) cleaning piles and a mesh surface (3). The length of the pile in the upper part of the cleaner is 3645 mm, and those in the lower part are 3990 mm, the total diameter of the rotation shaft is 550 mm, and the screw pitch is 300 mm. The screw conveyors are equipped with 4 piles (4) with a diameter of 14 mm and a length of 75 mm, and the distance between the piles is 70 mm. A mesh surface with dimensions of 6x50 mm is installed under the screw conveyors. The distance between the screw conveyor and the mesh surface is 16-18 mm, the rotation speed of the screw conveyor is 7.0 m/sec, and the productivity of each section is 5-6 t/h [4].

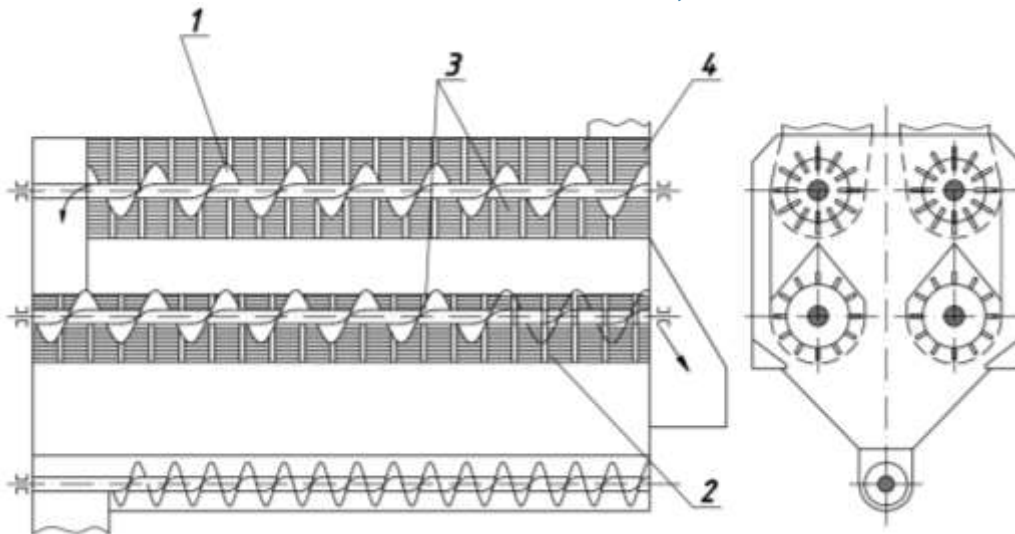


Figure 1. Schematic diagram of the 6A-12M screw cleaning equipment: 1 - upper screw conveyor; 2 - lower screw conveyor; 3 – cleaning ribs; 4 – pile.

The cotton supplied to the cleaning machine is divided into two equal parts and evenly distributed across each section. Initially, it is cleaned in pile screws located in the upper part. At the end of these screws, the cotton is directed through a connecting vertical shaft to the lower pile screws, where it moves in the opposite direction [5]. The pile screws loosen the cotton and, through impact, remove fine impurities from its composition. Additionally, the pile screws rotate around their axis, moving the cotton along the mesh surface. The fine impurities separated in each section fall into the impurity screw and are discharged outside the machine [4-6].

When comparing pile drum cleaning machines and pile screws cleaning machines, both systems clean the cotton by loosening it and striking it as it moves across a mesh surface or a cleaning rib. However, the differences in the movement of cotton within these machines result in variations in the cleaning process.

In pile screw cleaners, the supplied cotton is distributed along the entire length of the pile drum and moves between the pile drum and the surrounding mesh surface or cleaning ribs. In this case, the full surface of the pile drum is not utilized efficiently, and the cotton remains under the influence of the pile drum for a relatively short distance. The cotton is exposed to a single pile drum for approximately 0.4 seconds, which is insufficient to achieve the desired cleaning efficiency. Therefore, multiple pile drums are installed in pile screw cleaning machines to ensure effective cleaning. As a result, the duration of the cotton's presence in the cleaning zone increases, leading to higher cleaning efficiency [7].

Observations indicate that cotton remains in the pile screw cleaning machine for an average of 20–25 seconds. During this time, repeated impacts and loosening actions occur, making the cleaning process more intense and effective.

Research method. The research was conducted at the Rishton cotton ginning enterprise on a 6A-12M cleaning machine with an improved screw conveyor (see Figure 2). The experiments were conducted on raw cotton of the Nam-77 selection variety with an initial moisture content of 7.8% and a trash content of 5.3% (fine - 4.0%, large - 1.3%).

An improved version of the screw conveyor was installed in the lower row of the 1st section of the 2nd of two adjacent 6A-12M cleaning machines. The possibility of comparison was created

for the entire equipment or sections. It was also studied whether the experiments were carried out in production conditions and how they affected the quality indicators of the final product fiber. To reduce the errors of the research results, the experiments were conducted in 5 repetitions, and the average results were recorded. Samples were taken from the cotton gin being fed into production at the start of the experiment, before and after the 6A-12M equipment, from each section of the equipment, and after the CCC cleaning line. Also, samples were taken from the saw gin and the final product fiber.



Figure 2. General view of the improved screw conveyor installed on the 6A-12M equipment.

Results of applied research. The results of the research conducted to improve the 6A-12M fine impurity removal equipment are presented in Table 1 below.

Table 1

Results of research on improving the 6A-12M fine impurity removal equipment

№	Indicators	Available 6A-12M	Improved 6A-12M
1.	Initial humidity, %	7,8	7,8
2.	Initial impurity, %	5,3	5,3
	Of these, small	4,0	4,0
	large	1,3	1,3
3.	The contamination after passing current 6A-12M, %		
	Of these, small	1,6	-
	large	1,1	-
4.	The contamination after passing improved 6A-12M, %		

	Of these, small large	- -	0.5 0.7
5.	Impurity after the CCC (cotton cleaner combined) cleaning line, % Of these, small large	0.5 0.3	0.3 0.2
6.	Impurity on the groove of the gin equipment, % Of these, small large	0.4 0.2	0.2 0.1

Analyzing the results of the study presented in the table, the initial impurities of cotton were 4.0% for fines and 1.3% for coarse, while the impurities after passing through the existing 6A-12M fines cleaning equipment are 1.6% for fines and 1.1% for coarse. A reduction of fines and coarse by 2.4% and 0.2% respectively is achieved.

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