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ANALYSIS OF LOSS OF FREE ZONE IN THE WORKING CHAMBER AND INCREASING CLEANING EFFICIENCY BY INCREASING THE ROW OF PILE IN THE DRUM OF WOOL CLEANING EQUIPMENT

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ABSTRACT

In this article, pile drums and columns of the equipment for mechanical cleaning of wool fiber impurities have been improved and the cleaning efficiency has been increased.

ENTER. Wool fiber has a high level of contamination compared to other textile fibers. Wool contains two types of impurities: impurities released from the animal itself and impurities not related to the animal. Non-animal pollution includes fragments of minerals, plants, nutrients, soil [1]. The main process in primary wool processing enterprises is carding and cleaning, which determines the quality and cost of wool fiber. Impurity in wool is on average 40-70%. Wool fiber is cleaned mainly in 2 different ways: mechanical and chemical methods. In the mechanical method, the wool fiber is washed and cleaned with the help of scouring-cleaning aggregates, and in the chemical method by washing with the help of solutions and alkalis [2]. Initially, the sorted wool fibers are sorted by manual labor and transferred to the cleaning units by means of a conveyor. Grinding-cleaning aggregates consisting of drums with piles help to grind the fiber bundle and clean the dirt contained in it [3].

RESEARCH METHODOLOGY. At present, 2BT-150Sh equipment is mainly used in primary wool processing enterprises in our country (Fig. 1). The process of combing and cleaning wool is carried out with the help of drum with piles and grids with colosniks of the equipment [4; 3-4 pp.]. In cleaning equipment, the cleaning process is carried out together with the cleaning process, and these processes are considered the main ones. In cleaning the wool fiber

By eliminating or reducing the bond (elastic force) between the fiber and the impurities, the impurity is separated.

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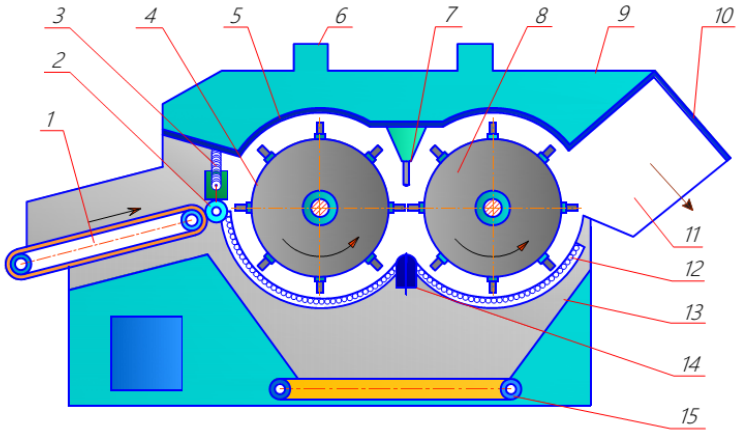

Figure 1. Scheme of the 2BT-150-Sh power unit

In our country, mechanical cleaning method is mainly used to clean wool fiber. In the mechanical cleaning method, the moving fiber is separated into small pieces under the impact of the pile drum.

ANALYSIS AND RESULTS. At the "Hisori Mayin Jun" LLC enterprise located in Oltinsoy district of Surkhandarya region, the amount of foreign impurities in local sheep's wool was determined and studied by comparison with the sample (Table 1).

Table 1

The amount of impurity compounds in Hisori sheep wool

Type of wool	Average dirt content of wool, %				
	Plant compounds	Mineral compounds	Moisture	Fat-sweat	Fiber
Hisori sheep wool	3,5-4,4	6,5-15,7	7,2	11,5-12,8	54-79

When the amount of impurities in local coarse wool was studied, the percentage of foreign impurities was found to be 20-37%. In the conducted experiment, it was determined that 13-14% of the total impurities contained in the wool fiber were processed for 1 hour in the 2BT-150Sh equipment during the grinding process. Productivity was 670 kg/h. It was found out from the obtained results that this indicator is low for the efficiency of the enterprise and has a negative impact on energy consumption, time, and economic efficiency.

In order to increase the cleaning efficiency, it was proved that the expected result cannot be achieved by increasing the rotation speed of a pair of pile drums in the working chamber.

J=Je-Jf (1)

J-is the number of machines (passes) in the system, which represents the speed of movement of the working parts that clean them. If we increase the level of *J*, the efficiency S and the harmful effect *Z* also increase. Up to a certain value of *J*, the harmful effect is almost unnoticeable (Fig. 2) up to the point *M* (*Md* curve). If the number of machines *J* in the system increases the rotational speed of the cleaning parts, the harmful effect *Z* of the system increases sharply (*dZ* Fig. 2, curve), while the efficiency S remains unchanged (*AS* curve) and gradually fades [5; pp. 36-59].

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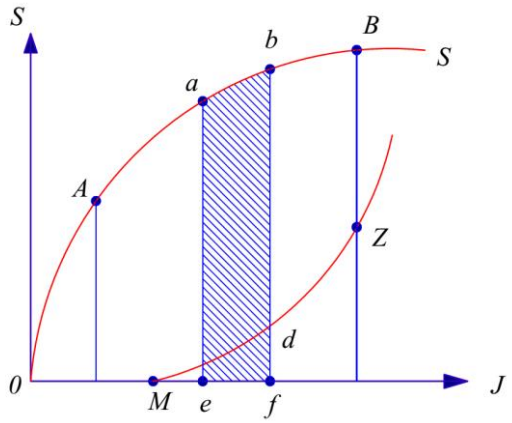
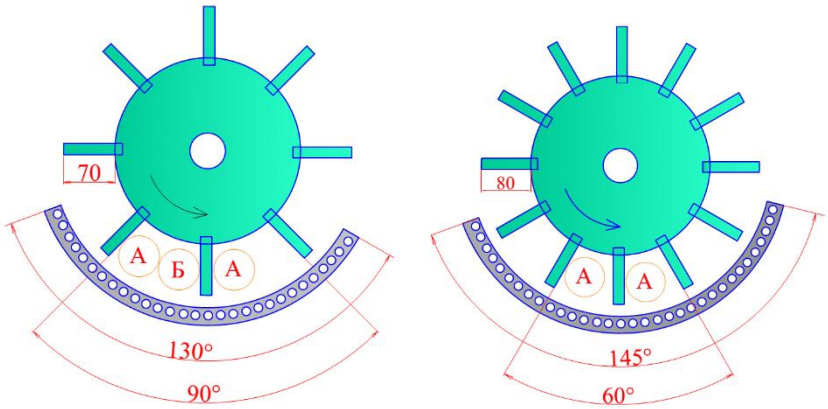


Figure 2. Dependence of grinding efficiency on pile drum speed

In experimental practice, it is necessary to choose the process of combing and cleaning wool according to J=Je-Jf. The surface *e a b f* in the graph indicates the useful operating limit of the machine system.

Depending on the dirtiness of the wool, it is recommended to increase the number of piles. In order to increase the efficiency of grinding and cleaning, the row of piles of the pile drum has been increased from 8 to 12, and the number has been increased from 44 to 66 (Fig. 4a,c). The empty zone is reduced, the raw material removal zone is increased, and the efficiency of fiber cleaning is increased (Fig. 3).

The diameter of the proposed drum with piles is 460 mm, and the length of the piles is 80 mm (Fig. 4). As a result of the piled drum mechanically moving the fiber bundle over the colossal grid, the impact on the fiber separates the fiber content into pieces. The piles are installed in 12 rows at an angle of 900 degrees to the drum, with a diameter of 15 mm (Fig. 4).



a) b)

Figure 3. Schematic diagram of a-existing and b-proposed pile drum. a-fiber removal zone; b-empty zone.

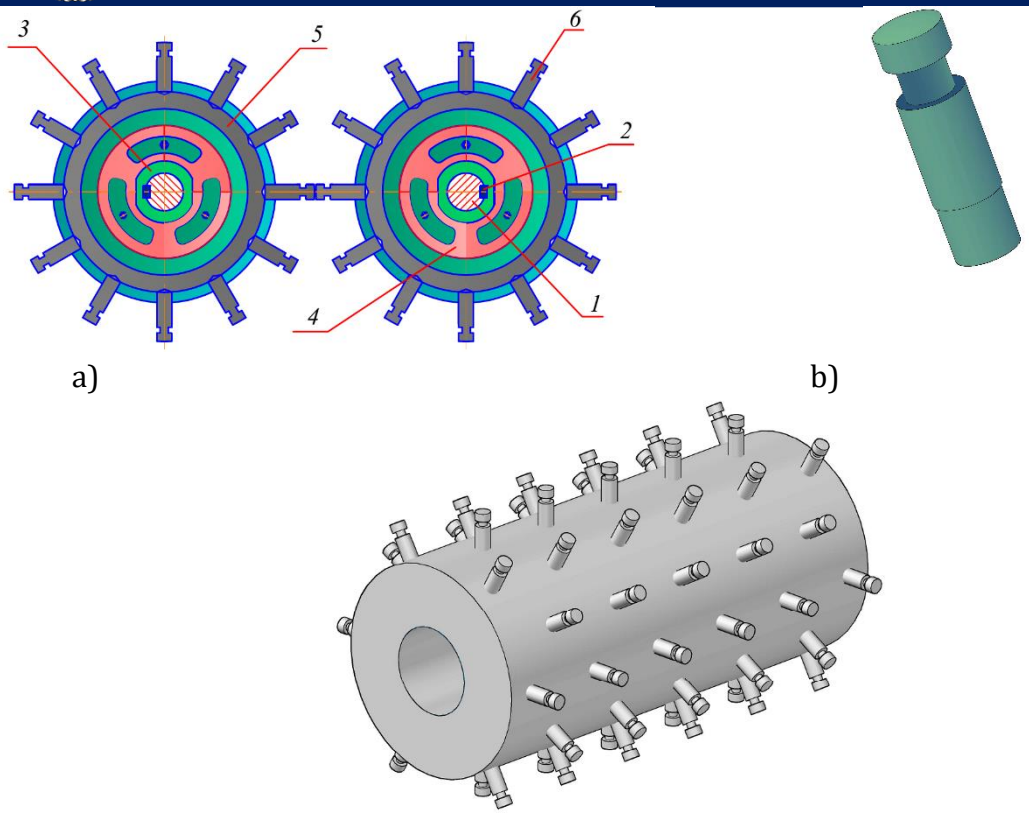


Figure 4. Improved pile drum and pile appearance; a) schematic structure of the drum; b) pile; s) clear image of the drum. 1st shaft; 2-key; 3 fastening detail to the case; 4th gasket; 5th drum; 6-piles

By increasing the row and number of piles in the pile drum, the b-empty zone in the existing equipment was eliminated. As a result, the cleaning efficiency increased from 13% to 21.2% (Table 2).

Table 2

Impurities separated from the composition of wool fiber during the cleaning process

Domestic sheep's wool	Total impurity amount of impurities, %	
	The amount of dirt in the wool,%	The amount of dirt after the combing process,%
Autumn	32,0	18,0
Spring	27,0	21,2

In the working chamber of the proposed new equipment, the wool cleaning efficiency increased from 13% to 18.0%, and the productivity increased from 670 kg/h to 756 kg/h.

The efficiency of fiber product cleaning for one machine is determined by the following formula.

$$R=S_{ch} / S_T \cdot 100 \ [\%] \qquad (2)$$

S_{ch} – solid impurities and specific ash contained in the separated waste when processing 1 ton of the mixture, kg.

S_T – 1 ton of solid dirt and special wood in the mixture, kg.

The cleaning efficiency of the fiber product for the cleaning unit is determined by the following formula: [2; 41 p.].

$$R_{agr} = (Sch_1 + Sch_2 + ... S_{chn}) / S_T \cdot 100\ \% \quad (3)$$

Sch_1, Sch_2, ... S_{chn} – solid impurities and specific waste in the waste of individual machines, kg (when 1 ton of mixture is processed).

Summary. Currently, the world market is occupied by products made of artificial fibers. The reason is the cheapness and sufficient availability of raw materials. But the fact that such products cause serious damage to human health has not eliminated the need for natural fiber. On the contrary, the demand for wool fiber products is growing year by year. The cleaning process plays an important role in obtaining a quality product from wool fiber.

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