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IMPROVING THE SHOVELS OF THE DRUM DRYER OF THE COTTON PROCESSING PLANT TO INCREASE THE VIBRATION LEVEL OF COTTON

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Abstract: In the article, instead of the shovels in the inner part of the drum, concave-shaped shovels were installed, and in the middle of the concave-shaped shovels, 150 mm high, 18 mm diameter stakes made of wire (prut) were installed. As a result, it is possible to throw the cotton into the useless zone of the inner chamber of the drying drum, and to dry the seeded cotton evenly over the entire surface of the drum. Throwing the cotton in the useless zone and ripping it, in turn, allows accelerating the release of moisture in the seeded cotton and makes it possible to efficiently use the heat of the hot air supplied to the drum.

Keywords: cotton, moisture, dirt, supply auger, drum, reducer, shovel.

Introduction

In cotton cleaning enterprises, cotton drying is the main production process for processing seed cotton, which involves preserving the natural properties of the fiber, obtaining high-quality fiber, and ensuring the efficient operation of equipment. The quality of the produced product depends on the preparation of seed cotton for storage, storage conditions, and readiness for processing in factories. From this perspective, the main operation of the preliminary processing technological process of cotton involves drying seed cotton, especially seed cotton harvested by machine harvesting. According to the regulations of the preliminary processing of seed cotton, the drying function is carried out in the drying-cleaning units of cotton

cleaning plants. These units are equipped with a set of technological machines and mechanisms, including drying drums.

Practical Research

Instead of the shovels in the inner part of the drum, concave-shaped shovels were installed, and in the middle of the concave-shaped shovels, 150 mm high, 18 mm diameter stakes made of wire (prut) were installed. As a result, it is possible to throw the cotton into the useless zone of the inner chamber of the drying drum and to shake the seed cotton evenly across the entire surface of the drum. Throwing the cotton into the useless zone and shaking it accelerates the moisture release from the seed cotton and enables the effective use of the hot air heat supplied to the drum. At the same time, the shaking of the cotton helps to separate small dirt particles from the cotton.

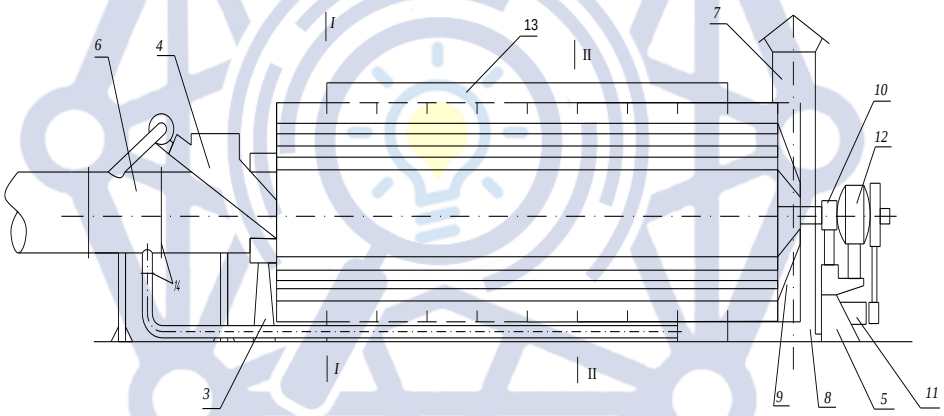

Figure 1. Cross-sectional diagram of the 2SB-10 model drying drum.

1 - Drum; 2 - Shovels; 3 - Front support; 4 - Feeder; 5 - Rear support; 6 - Drying agent nozzle; 7 - Front axle; 8 - Shaft; 9 - Discharge hatch; 10 - Discharge shovels; 11- Spacers; 12 - Bearing; 13 – Drum drive electric motor; 14 - Reducer.

Disadvantages of the Drum

1. There are cases of clogged wet cotton in the feeding auger.
2. The fiber becomes tangled in the feeder and drum, which negatively affects the quality characteristics of the fiber.
3. The surface of the drum's cross-section is not fully utilized, meaning the internal shovels need to be improved.

4. The first 2-3 meters at the beginning of the drum are not utilized because the high air speed blows the seed cotton away.

When analyzing the work of G.V. Bannikov, it was determined that the diameter of the drum is related to its productivity, while its length is determined by the level of heat utilization.

$$Д_Б = \sqrt{\frac{4G_{ХБ} * \tau_Ф}{\pi * \alpha_Б * \rho_X * \beta}}$$

Where: $\alpha_Б$- Length of the drum, mm;
$G_{ХБ}$ - Weight of the cotton inside the drum, kg;
ρ_X - Bulk density of the cotton inside the drum, kg/m³;
β - Filling coefficient;
$\tau_Ф$ - Residence time inside the drum

To study the movement of seed cotton inside the drum, Bannikov divides the cross-section of the drum into three zones:

- Zone of falling seed cotton
- Zone of seed cotton standing on the shovels
- Zone not filled with seed cotton

The residence time of the seed cotton inside the drum is determined as follows:

$$\tau_{пр} = \frac{G_{хл}}{RF_{хл}} = \frac{\alpha_б}{30v_{тф}K_в\rho_т}$$

Where: $G_{ХЛ}$ - Gravitational force on seed cotton;
R - Total aerodynamic resistance force;
$F_{ХЛ}$ - Middle cross-sectional area, m²;
$\alpha_Б$- Length of the drum, mm;
$v_{тф}$ - Average velocity of the heat agent relative to the seed cotton, m/s;
$K_в$ - Impact coefficient;
$\rho_т$- Density of the heat agent, kg/m³

Professor A.P. Parpiyev identified methods to accelerate the drying process of seed cotton in a convective drum.

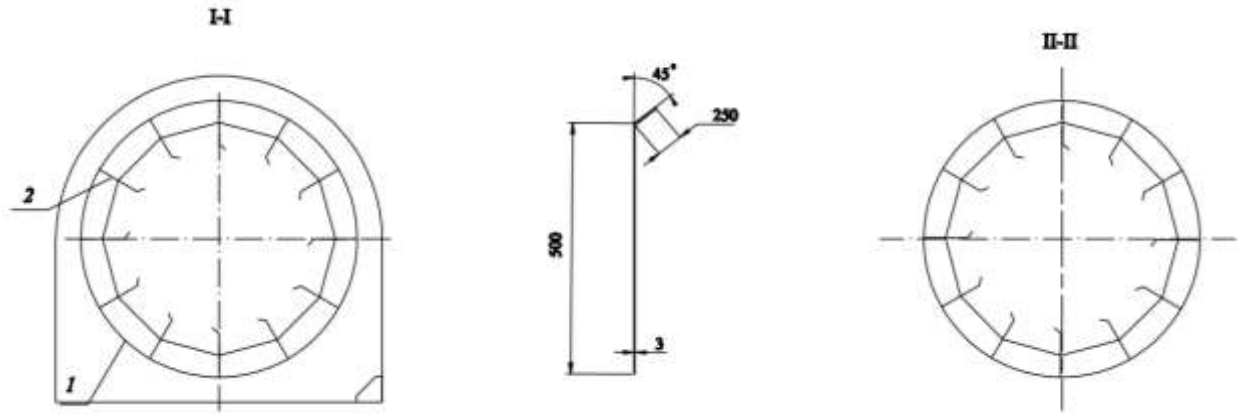

Figure 2. View of the proposed shovel.

1. *Transverse shovel*
2. *Longitudinal shovel*

Advantages of the Improved 2SB-10 Model Drying Drum:

1. The productivity of the drum in terms of seed cotton is very high, up to 12 tons.
2. The shovels evenly shake the seed cotton.
3. The components of the seed cotton dry according to the standard.
4. The drum's drying chamber allows the even distribution of seed cotton over its entire surface, providing uniform shaking as well.
5. The stakes at the ends of the shovels ensure that the seed cotton is evenly shaken, allowing the heat flow to pass between each cotton piece and evenly remove moisture from the seed cotton.
6. The temperature of the used air exiting the drum decreases by 40-50%.
7. It allows drying of high-moisture seed cotton even at low temperatures.
8. The moisture removal from seed cotton in the drying chamber increases by 15-20% compared to the old version.
9. The temperature of the hot air supplied to the drying drum is 180°C, which leads to lower energy consumption. This also helps maintain the natural quality characteristics of the fiber.
10. The temperature of the used air exiting the drum decreases by 40-50%.
11. It enables the drying of high-moisture seed cotton even at low temperatures.

12. The moisture removal from seed cotton in the drying chamber increases by 15-20% compared to the old version.

13. The temperature of the hot air supplied to the drying drum is 180°C, which results in lower energy consumption and helps maintain the natural quality of the fiber.

Conclusion

Based on the results obtained, the design allows the cotton to be thrown into the useless zone of the drum's inner chamber and evenly shaken across the entire surface of the drum. This leads to faster moisture separation from the cotton and more efficient use of the heat from the hot air entering the drum. Additionally, the improved shaking of the cotton helps remove small impurities from the cotton.

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