DETERMINATION OF THE USABLE AREA OF THE IMPROVED GRID BAR

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Abstract
In the article the grate, which is the main working part of the process of cotton cleaning at cotton ginning plants, is improved, and also the useful surface of the improved grate is determined using modern computer programs. As a result, a certain reduction of the useful surface of the grate and its mass compared to the existing grate has been achieved.

Keywords: Cotton, fiber, seed, lint, cleaner, calosnik, mesh surface, inlet pipe, outlet pipe, saw gin, roller gin, press, stone catcher.

Introduction

Cotton ginning plants are one of the main parts of the cotton-textile cluster system. At cotton ginning plants, cotton raw material is received from farms and processed to prepare finished bales.

The main process in the plant is the cotton cleaning process. The contaminants released during the cleaning process vary in origin, size and the technical technologies used in the cleaning process to remove contaminants.

Contaminants in raw cotton are categorized by origin into active and passive contaminants. Active impurities are located inside the raw cotton. Passive impurities are located on the surface of the raw cotton. Therefore, in the cotton processing process, the process of cleaning of minor impurities is carried out first. Then the process of cleaning from coarse impurities is carried out. Fine and coarse raw cotton impurities differ in size, and impurities smaller than 10 mm are called fine impurities and impurities larger than 10 mm are called coarse impurities. In cleaning the above mentioned impurities, the cleaning process is carried out in technical technologies consisting of a cone drum, a mesh surface, a saw drum and a shoe drum.

Nowadays cotton cleaning is considered as one of the main processes of cotton ginning plants. In farms, it is very relevant to carry out research and development work on increasing the number of weed impurities in the cotton composition and efficient technologies of the cleaning process due to the fact that the cotton cleaning process is carried out in machine picking [1-3].

In the cotton cleaning process, grates are used to clean the cotton and separate the harmful substances. These grates play an important role in separating the outer shell of cotton. However, their use has some disadvantages. Incomplete cleaning of cotton on the grate can adversely affect the quality of raw cotton.

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Methods

Based on the above disadvantages, in order to improve the purification efficiency, the authors propose a new calosnik. (Fig. 1). As a result of the introduction of this grate in the production process is achieved an increase in the efficiency of cotton cleaning with an increase in the useful surface compared to the existing grate [4-7].

Figure 1. Improved grate.

When cleaning raw cotton from impurities, if large impurities are trapped between the grates, they can also fall through the oval holes on the grate surface. Both fine and coarse contaminants are caught. Since the distance between the saw drum and the grate is 12-14 mm, the raw cotton bolls are also shredded when they fall into this gap. This results in the appearance of fine contaminants. Therefore, when cleaning raw cotton in the UCC unit, the sequence of operation of staking and sawing drums is set repeatedly. In the process of cleaning from large impurities in the saw drum small impurities are formed, so raw cotton is again fed to the stake drum. A mesh surface is formed in the introduced grates with holes. As a result, the cleaning of fine impurities in the raw material facilitates the operation of the saw drum, which leads to an increase in efficiency and quality.

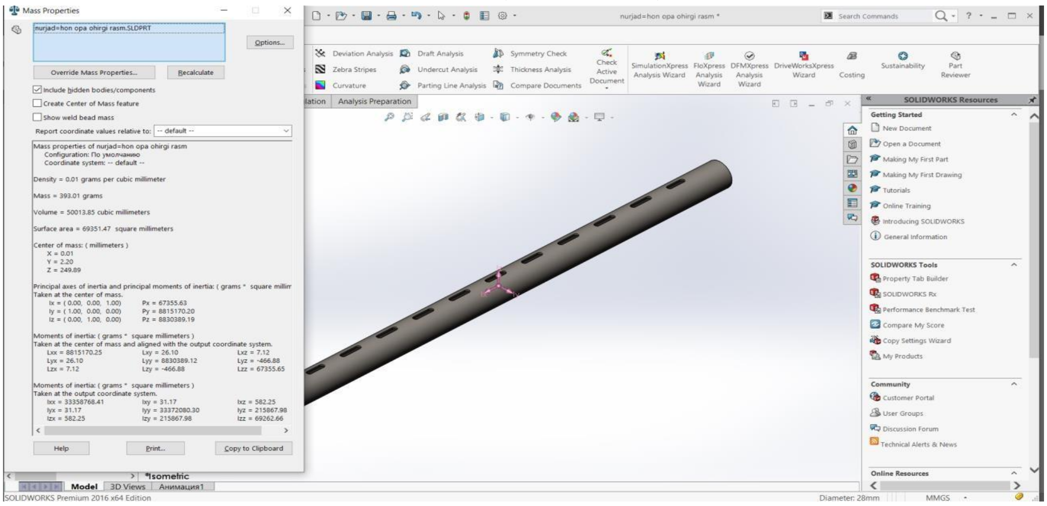


Figure. Data of calosniki with an open hole.

Figure 1 shows the data of the gasket with a hole, as can be seen, the mass of the gasket was 393.01 grams.

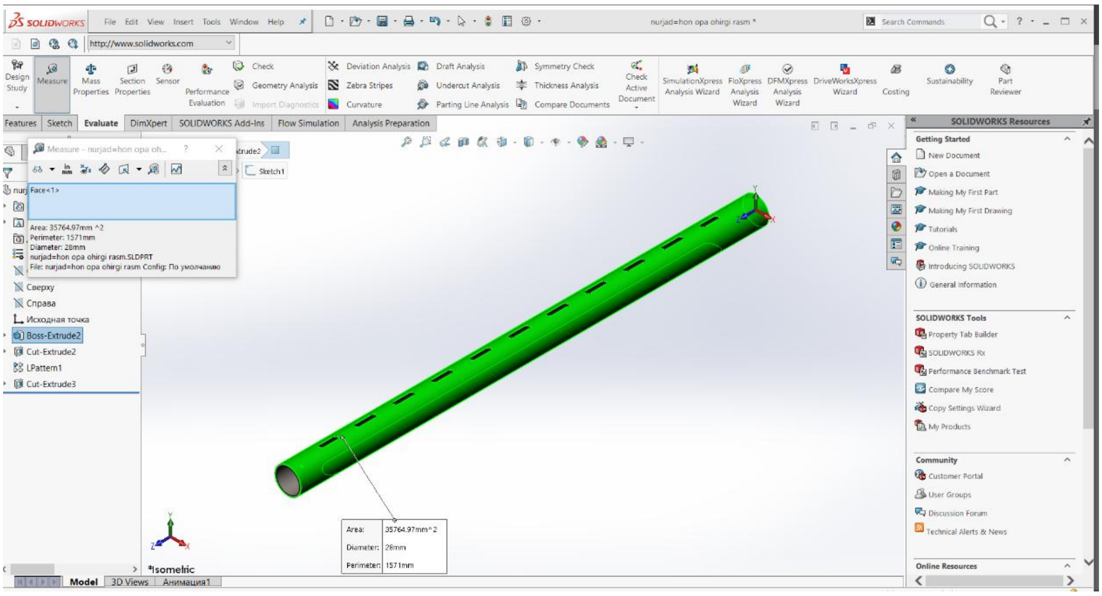
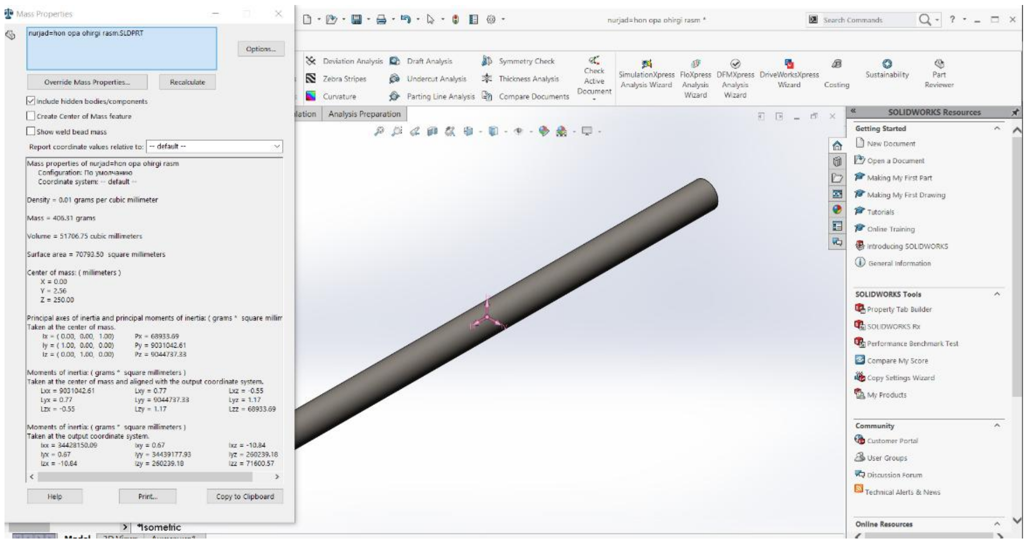


Figure 3. Area of the gasket surface.

Using the evaluate program of the Solidworks program, we determined the area of the mesh surface 35764.97 mm2 using the measuare button. At the next stage, the mass and surface area of the grate before perforation were determined.



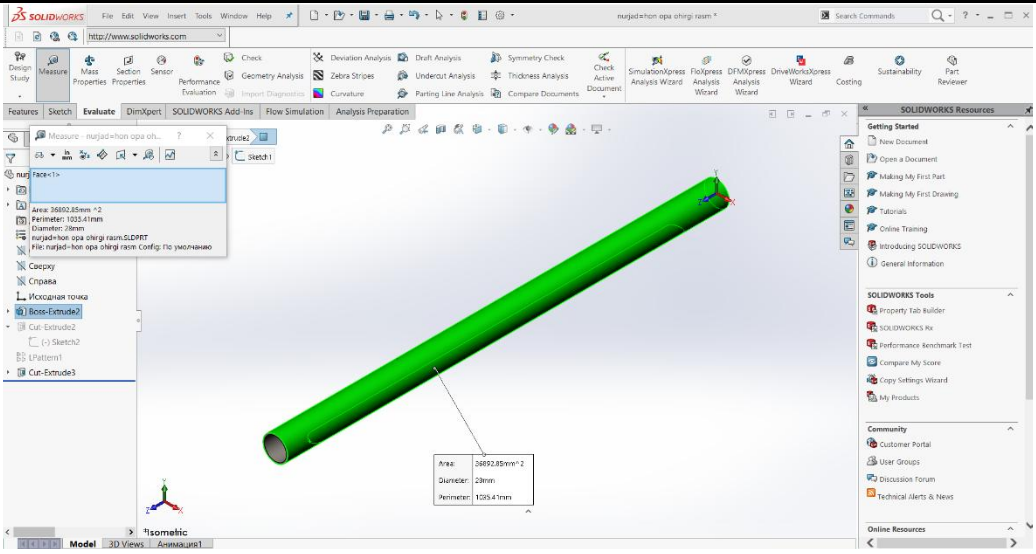


Figure 4. Mass and surface area of the gasket before perforation

As can be seen, the mass of the mesh surface was 406.31 grams, and the area was 36892.85 mm^2.

To find the useful area F_f, we subtract the sheet area F after the hole is formed from the total area F_t:

$$F_f = F - F_t = 36892.85 - 35764.97 = 1{,}127.88 \text{ mm}^2,$$

Substituting the obtained results into expression (1):

$$k_{f.yu.} = \frac{1{,}127.88}{36892.85} \cdot 100\% = 3.05\%$$

We can also find the percentage of the weight we've lightened by subtracting the next weight from the previous weight and dividing it by the previous weight (which usually corresponds to the efficiency coefficient):

$$\frac{406.31 - 393.01}{406.31} \cdot 100\% = 3.27\%$$

Consequently, the effective surface area coefficient of the mesh surface adopted by us is equal to $k_{f.yu.} = 3.05\ \%$, and a 3.27% reduction in the grate weight was achieved.

Results and Discussion

We conducted experiments by installing 10 of them on the bottom of the saw drum with a grate with a perforated surface. Therefore, the useful surface, determined by us using the Solidworks program, was calculated for an improved grate. We also calculated the location of the grate with 10 holes located at the bottom of the saw drum.

In this case, the effective surface area coefficient was $k_{f.yu.} = 3.05 * 10 = 30{,}5\ \%$. A 32.7% reduction in the grate weight was achieved.

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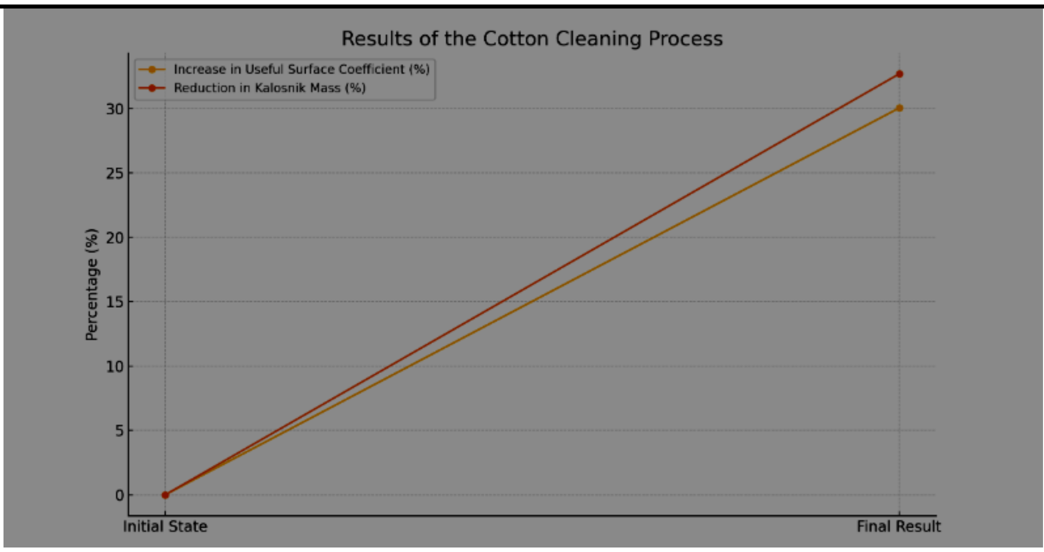

Figure 5. Results of the cotton Cleaning Process

In practical experiments, an experiment was also conducted in the separation of raw cotton cleaning from large weed impurities on the UCC unit with an improved grate. The purpose of the improved design is simultaneous cleaning of raw cotton from coarse and fine impurities. Experiments were conducted on cotton variety Andijan-35. In the experiment it was found that 350 grams of large and 150 grams of small impurities were extracted from ten kilograms of cotton. Laboratory analyses conducted after the experiments showed that the content of weed impurities in raw cotton decreased from 8.66% to 2.01%. Whereas in the existing calosnik the contamination of raw cotton was reduced by 3.03%, in our improved calosnik it was reduced by 2.01%. This result determines the effectiveness of the conducted experiment, because in the UCC unit raw cotton is cleaned in three consecutive stages. First it is cleaned on the stake drum, then on the saw drum and again on the stake drum. The result obtained is the conclusion of the experiment conducted on the saw drum itself.

The purpose of the work carried out by the authors is to increase the efficiency of cleaning by improving the design of the UCC unit when cleaning raw cotton from weed impurities. The new design resulting from our above research work is characterized by the fact that it performs two functions simultaneously. The experiment conducted on the design evaluates the economic efficiency. Improvement in cleaning efficiency is achieved by increasing the usable surface area due to the formation of an opening in the grate with aperture.

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