ISSN 2181-8622

Manufacturing technology problems

Scientific and Technical Journal Namangan Institute of Engineering and Technology

INDEX COPERNICUS INTERNATIONAL

Google Scholar

Crossref doi

SLIB.UZ Scientific library of Uzbekistan

Volume 9
Issue 3
2024

ANALYSIS OF THE INFLUENCE OF THE FILLING COEFFICIENT OF THE SCREW CLEANER SYSTEM WITH SEEDED COTTON ON THE CURRENT CONSUMPTION OF THE SYSTEM

RAKHMONOV KHAYRIDDIN
Professor of Bukhara Engineering Technological Institute, Bukhara, Uzbekistan
Phone.: (0590) 718-7125, E-mail.: raxmon@mail.ru

MATYAKUBOVA JUMAGUL
Assistant of Urgench State University, Urgench, Karakalpakstan
Phone.: (0594) 117-1114, E-mail.: matyakubovajumagul@gmail.com

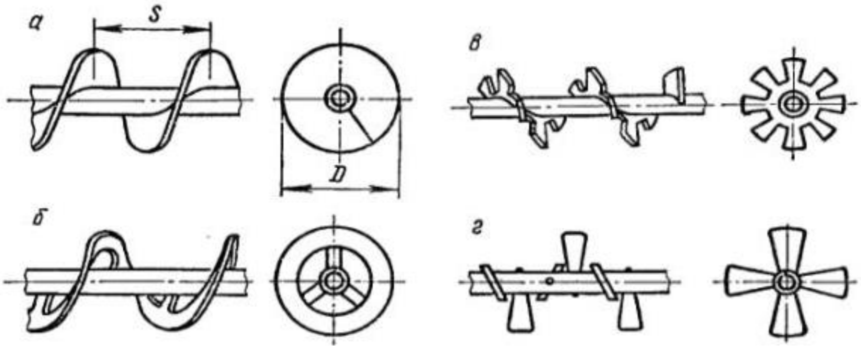
SOBIROV DONIYOR
Senior teacher of Urgench State University, Urgench, Karakalpakstan
Phone.: (0591) 421-7833, E-mail.: sabirov19861010@gmail.com
**Corresponding author*

Abstract: This article substantiates the possibility of increasing the productivity and efficiency of cleaning process machines by improving the design of the screw cleaner, which ultimately allows you to get high-quality products. Also, the factors affecting the movement of raw cotton in the chute of the device are determined, a scheme for calculating the movement of raw cotton together with the flow of hot air in the feed zone, as well as the forces acting on the surface of the mesh is presented. To solve the problem of the process of feeding the flow of raw cotton in a stationary mode, it is established that the pressure must be positive at an arbitrary section of the cross-section. In the article, using the Maple program, the dependence of the flow of raw cotton Q is determined for different values of the filling factor of the flow of raw cotton transferred from the hopper of the device, which are presented in the form of graphs.

Keywords: seed, cotton, screw cleaning, flow, process.

Introduction. By developing improved constructions of resource-efficient screw cleaners that perform the cleaning process, it is possible to increase the productivity of technological machines and achieve higher product quality. As a result of the creation of new designs of screw conveyors used for product cleaning in manufacturing enterprises, it is possible to increase the efficiency of technological machines, to make the working parts of the machines work for a long time, to increase the productivity, and to prevent the spare parts from colliding with various objects and being eaten by friction. Currently, in the cotton ginning industry, along with other vehicles, screw gins are used. Screw conveyors are used as distributors that distribute cotton raw material to the supply devices of ginning machines and ginning machines [1]. Screws are assembled from separate joints (links). The length of the screw can be different depending on the distance of cotton raw material transportation. The screw pipe is made of 3-4 mm thick steel plates with separate joints. The rigidity of the pipe is provided by longitudinal and transverse edge angles. The upper part of the screw is equipped with removable covers, and a supply system is installed on the side. In screw cleaners, the main driving mechanism is the screw.

Screw cleaners are mostly horizontal (G), at an angle to the horizon. The shell diameter and screw pitch are variable or fixed, the number of screw threads is single or double, the screw direction is right (P), left (L) or combined (K). The construction of the conveyor spiral is different, with a flat surface (for transporting fine-grained materials, cement, flour, gypsum, etc.), with a belt (for transporting granular products), with a profile (for cement and its mixtures, clays, etc.), with a blade (for mixing). are in forms (Fig. 1). Screw conveyors can be placed at an angle of up to 30°S relative to the horizon. Bearing supports are installed every 2.5-3 meters of the screw shaft. [2].



a- flat surface, b- ribbon, v- shaped, g- lobed

Figure 1. Screw types of auger wipers.

The screw diameter and screw pitch dimensions of auger cleaners are shown in Table 1 in accordance with GOST 2037-82 (the screw pitch should be small for transporting dense materials)

Table 1. Screw conveyor diameter and screw pitch dimensions.

Diameter, mm	Step, mm	Diameter, mm	Step, mm
100	80; 100	320	260;320
125	100; 125	400	320;400
160	125; 160	500	400; 500
200	160; 200	650	500; 650
219	270; 219	800	650; 800

When transporting or mixing granular materials, the diameter of the screw must satisfy the following condition $D_{\min} \geq a_{\max} k_{h\min}$ [3].

Methodology & empirical analysis.

Setting the problem and problem to be solved.

In order to increase the periodicity of the mechanisms of auger dusters in the transportation of seed and to reduce the vibration movement of the screw shaft, it is of great importance to theoretically study the movement of seed cotton falling from the threshing floor in a stream.

Identifying the factors affecting the movement of seeded cotton and analyzing its parameters, in particular, provides an opportunity to implement a positive approach to the creation of new constructions. Figure 2 shows the analysis of the parameters of the seeded cotton moving along with the air flow in the warp, which represent the dependence of the forces acting on the mesh surface. In addition, we assume that the flow behavior of seed cotton on the AVSE surface is one-dimensional (Fig. 2).

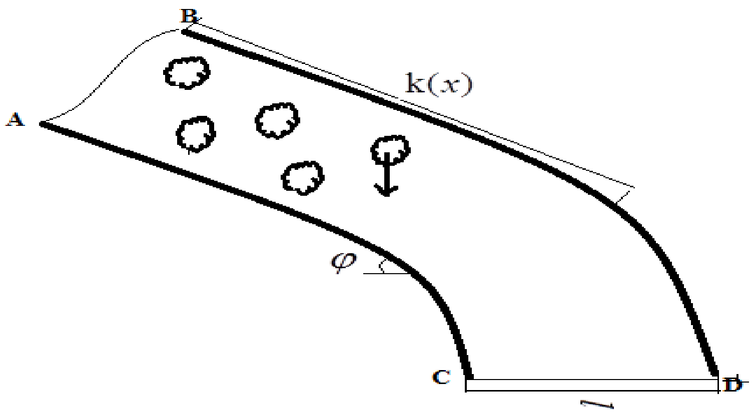


Figure 2. The scheme of the flow of Q cotton in the yarn.

In that case, we write the cotton flow using Euler's equation. The equation for the AVCD surface is as follows;

$$\rho \cdot \vartheta \cdot S \frac{d\vartheta}{dx} = -\frac{d(S \cdot p)}{dx} \qquad (1)$$

Here is the density in the zone; ρ - speed in the zone; ϑ P - pressure in the zone; $S = \mathrm{k}(x) \cdot l$ the law of change of the height of the tarnov along the coordinate OX axis, l - the length of the width of the tarnov. We integrate equation (1) based on the following condition.

We consider the movement of the seeded cotton stream coming down from Tarnov to be stationary. In this case, the amount of mass does not change per unit of time, i.e

$$\rho \cdot \vartheta \cdot S = \rho_0 \cdot \vartheta_0 \cdot S_0 = Q \qquad (2)$$

Here Q - seed cotton consumption,

According to these hypotheses, we will determine the speed and pressure of seed cotton flow in the zone. For clarity, we express the change of the cross-sectional surface along the coordinate OX by a linear law, i.e.

$$S = \mathrm{k}(x) \cdot l \qquad (3)$$

Here is the law of change of the consumption of the filling coefficient of the $k(x)$ - seeded cotton flow along the OX axis. In it $\rho = \rho_0 = const$ we determine the speed.

$$\vartheta = \frac{Q_0}{\rho_0 \cdot S} = \frac{Q_0}{\rho_0 \cdot l \cdot \mathrm{k}(x)} \qquad (4)$$

(1) equation $p = p_0$ $x = 0$ we determine the pressure by integrating under the condition that:

$$\mathrm{P} = P_0 - \frac{\rho \cdot Q_0^2}{l^2 \cdot (k(x) \cdot l)^2 \cdot \rho_0^2} \qquad (5)$$

(4), (5) formulas represent the laws of distribution of speed and pressure in the field of the flow of cotton with a variable cross-sectional area. In particular, the cross section does not change *k*=0 if, $P = P_0$ and $\vartheta = \vartheta_0 = \dfrac{Q_0}{\rho_0 \cdot l \cdot b_0}$ we get the values.

Constant speed and pressure of the cutting surface $\vartheta = \vartheta_1$ $P = P_1$ to be, we determine their value using these formulas.

$$\vartheta_1 = \vartheta(l) = \frac{Q_0}{\rho_0 \cdot (\mathrm{k}(x) \cdot l)} \qquad (6)$$

(6) formula seed cotton flow rate in the zone $\vartheta_1 = \vartheta_0$ to be, its value is from the speed at which the current is transmitted to the zone of the screw piles $n = \dfrac{\mathrm{k}_0}{k_1}$ shows that it will be twice as big. Using formula (7) for pressure $x = l$ we determine its value in the section.

$$P_1 = P(l) = P_0 - \frac{\rho_1 \cdot Q_0^2}{l^2 \cdot (k(x) \cdot l)^2 \cdot \rho_0^2} \qquad (7)$$

In the used calculation scheme, it is required that the pressure be positive in an arbitrary section of the tarn during the transfer of seed cotton flow. Such a requirement must be met in order to solve the process in a stationary state. If this condition is not fulfilled, one-dimensional flow movement cannot be observed in a stationary state. This requirement indicates that in practice, an additional condition for flow aerodynamics must be met. This condition results from the pressure being in a positive direction, and from formula (8) such a condition can be obtained [4]

$$P_0 \geq w^2 \cdot \frac{\rho}{\mathrm{k}(x) \cdot l} \qquad (8)$$

From this inequality, the following condition is obtained for the limiting angle of the supplier's rotation

$$tg\varphi = \mu < \frac{k(x)}{l} \cdot \frac{1}{w^2 + 1} \qquad (9)$$

Here $w^2 = \dfrac{Q_0^2}{l^2 \cdot (b(x) \cdot l)^2 \cdot \rho_0^2}$ height $\mathrm{k}(x)$ length l given the pressure, density and seed cotton consumption in the transfer section, (8) is the limiting angle that satisfies the inequality $\varphi = arctg\,(\dfrac{\mathrm{k}}{l} \cdot \dfrac{1}{\mu^2 + 1})$ can be selected. In Figure 1, the pressure P_0 two of $\mathrm{n} = \dfrac{k}{l}$

at different values of the ratio φ graphs of the relationship between supplier angle and seed cotton consumption Q are presented.

In calculation $l = 0.5м$ $b = 0.5м$ $\rho_0 = 1.2кг / м^3$ accepted. [5].

$$\varphi = arctg\left(\frac{k(x)}{l} \cdot \frac{1}{w^2 + 1}\right) \qquad (10)$$

Result. Experiment and analysis of obtained results. Based on the values obtained and used in the calculation, as well as the results of the data processed on the computer, the relationship between the cotton consumption Q at different values of the filling coefficient, the flow of seed cotton sent from the gin at different values of the filling coefficient, and the graphs using the Maple program We will give analyzes in the form of $P_0 = 300$ $Па$

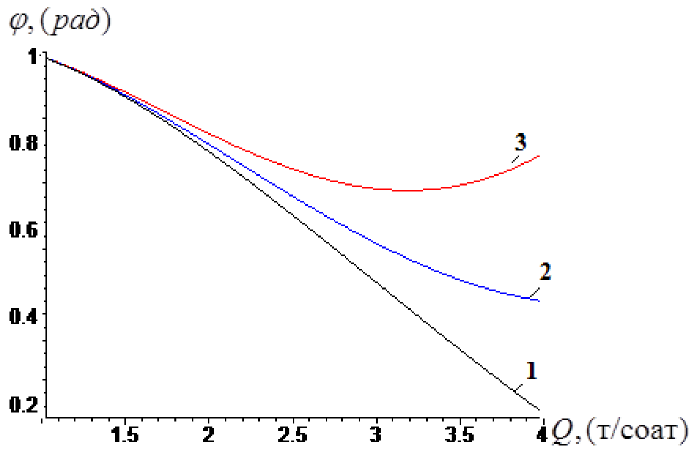


Figure 3. Boundary angle $\varphi(град)$ pressure of $P_0(Па)$ and the fill factor is different $k_1 = 0.2$; $k_2 = 0.4$; $k_3 = 0.6$; graphs of changes in cotton consumption in values

$P_0 = 400$ $Па$

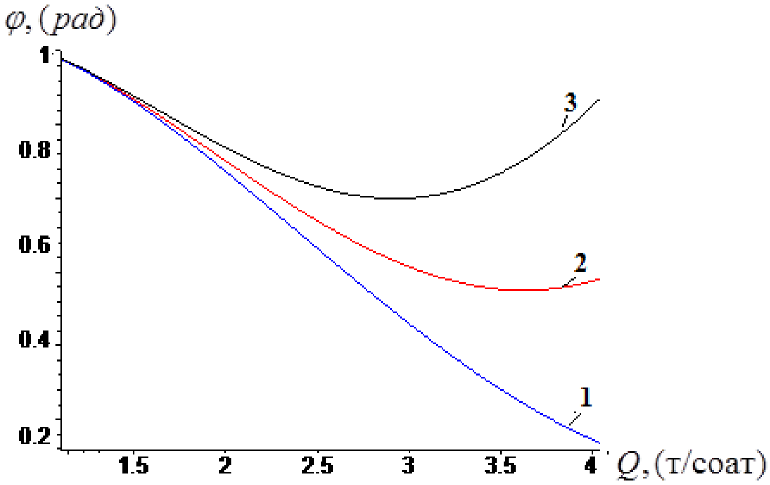


Figure 4. Boundary angle $\varphi(град)$ pressure of $P_0(Па)$ the two and the fill factor are different $k_1 = 0.2$; $k_2 = 0.4$; $k_3 = 0.6$; graphs of changes in cotton consumption in values.

Putting the expression (9) into the equation (4), we create the equation of dependence of cotton flow speed on the limit angle and cotton consumption [2].

$$\vartheta = \frac{Q_0}{\rho_0 \cdot S} = \frac{Q_0}{\rho_0 \cdot l \cdot (k - \frac{k}{l} \cdot \frac{1}{w^2 + 1} \cdot x)} \qquad (11)$$

From the expression (11), the analysis of graphs of the dependence of air consumption on the speed of the flow of seed cotton to the screw piles by the angle of the slope is presented using the Maple program.

$\varphi = 10^0$ $\varphi = 15^0$

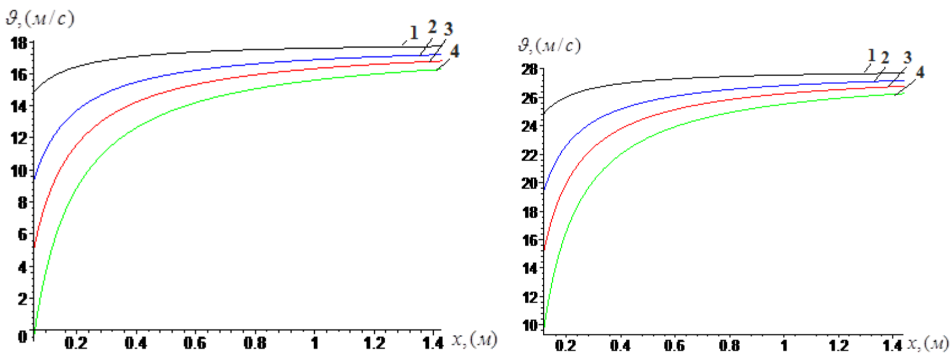


Figure 5. The rate of cotton flow is different from the consumption of cotton in the loom.

$Q_1 = 0{,}5t/h$ $Q_2 = 1{,}5t/h$ $Q_4 = 3{,}5t/h$ **graphs of changes in the values of the variable OX**

With the help of graphs presented in Figures 3, 4 and 5, it is possible to determine the value of the filling coefficient to ensure the transfer of seeded cotton in the gin without interruption of the process. For example: $k = 0{,}5м$, $l = 0.5м$ when received, $Q = 3{,}5t/h$ cotton consumption in a stationary state $P_0 = 300\ Па$ for the limiting angle for transmission in pressure $\varphi < 15^\circ$ the inequality should be reasonable, that is, to ensure a stationary state φ angle value 15^0 should be taken smaller than Only then can we see an increase in productivity.

Areas of application of the obtained results

In the analysis, it is possible to observe an increase in productivity in the axis of the auger cleaner and in the direction of the auger blade. For the limit angle in the defined values of the permissible filling coefficient of cotton in the transfer zone for screw cleaners in the paper $\varphi < 15^\circ$ it is stated that inequality is appropriate. The above-mentioned analyzes provide an opportunity to find solutions to theoretical and practical issues that have not yet been resolved in the development of cotton drying and cleaning technologies. It should be noted that the generality of the work and the cleaning efficiency of the equipment depend not only on the degree of drying of the cotton, but also on the external and internal forces affecting the seeded cotton. Because the separation of small impurities from the cotton pieces also depends on the impact force of the cotton on the surface of the mesh, i.e., the impulses of the impact. Therefore, the practical significance of the results obtained for the development of the theoretical basis for determining the impact pulses when hitting cotton on a mesh net is of great importance.

Conclusions. 1. By developing improved constructions of resource-efficient screw cleaners that perform the cleaning process, it is justified that it is possible to increase the productivity of technological machines and achieve higher product quality.

2. It is based on the fact that the analysis of the factors affecting the movement of seed cotton from the gin and the analysis of its parameters gives the opportunity to implement a positive approach to the creation of new constructions.

3. The relationship between the cotton consumption Q at different values of the filling coefficient of the seeded cotton flow transmitted from the gin was determined using the Maple program $k = 0{,}5м$, $l = 0.5м$ when received $Q = 3{,}5 t/h$ cotton consumption in a stationary state $P_0 = 300\ Па$ for the limiting angle for transmission in pressure $\varphi < 15^{\circ}$ it was shown that inequality should be appropriate. It is noted that only in this case, it is possible to observe an increase in work productivity.

References

1. Xayriddin Rakhmonov, and Jumagul Matyakubova Research of the Rotation Frequency of the Working Organs of an Auger Cleaner. Ye3S Web of Conferences 548, 03019 (2024). https://doi/org/10.1051/ye3sconf/202454803019

2. Rakhmonov, K., Fayziev, S., Qodirov, M., Temirov, A., Toyirova, G. Development of a resource-saving technology allowing to increase the yenvironmental sustainability of drying cotton raw materials Ye3S Web of Conferences 390, 06019

3.Vulfson N.I., Kolovskiy M.Z. Nelineynыe zadachi dinamiki mashin. – L.: Mashinostroenie, 1968. – 268 s.

4.Panovko YA.G. Osnovi prikladnoy teorii kolebaniy i udara. – Leningrad: Mashinostroenie, 1970. – 320 s.

5.Djuraev A. i dr. Dinamika sistemi privodov texnologicheskix mashin. – T.: Adabiyot, 1993. – 277 s.

C O N T E N T S