ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 8, Issue 1 , January 2021

# Construction of Parameters of Conusimon Columns to Remove Cotton from Big Dirty

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**ABSTRACT:**The article considers the impact of the impact of cotton pieces with conical column cleaners for cleaning large contaminants theoretically, based on the results of the analysis of the connection graphs of the parameters. The formula for determining the pulse of impact of a piece of cotton on the surface of a conical column is proposed.

**KEY WORDS:** Cotton piece, cleaner, grinder, speed, recovery, coefficient, mass, radius, angular speed.

## I.INTRODUCTION

Cleaning of raw cotton from stones, metal objects, organic contaminants and gutters has become a pressing issue in order to ensure the smooth operation of ginners in ginneries.

As a result of research to clean cotton from large wastes, a conical colossus was created to shake the raw cotton.

It is known that in existing cylindrical columns, the effect of cotton pieces is affected only in a plane perpendicular to the axis. However, it is expedient to analyze the spatial condition when cotton [1, 2]pieces are exposed to conical columns.

## II. MATERIALS AND METHODS

The calculation scheme and the mathematical model of the shock pulse Figure 1 shows the scheme of the angles formed by the impact of cotton pieces on the conical surface.

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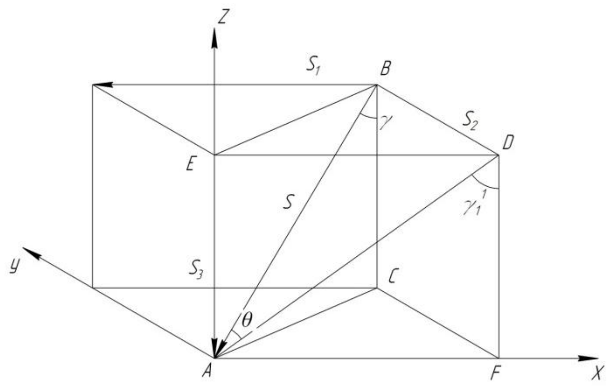


Figure 1. Scheme of interaction of cotton pieces on a conical surface

Under the influence of the impact of a piece of cotton on a conical surface, the impulse force is formed by three x, y, z axes.

$$S = \sqrt{S_1^2 + S_2^2 + S_3^2}; S_1 = Ssin\varphi_1 cos\theta;$$
$$S_2 = Ssin\theta; \; S_3 = Ssin\varphi; \qquad (1)$$

here $\varphi_1$,$\theta$, $\varphi$,-imulse pulse, $S$and the angles that determine the relative position of its constituents.

If the column is made cylindrical, the conical angle $\theta$ is zero, and the impulse acts only in the plane, i.e.$S$

$$S = \sqrt{S_1^2 + S_2^2}; \; S_1 = Ssin\varphi_1;$$
$$S_2 = Ssin\varphi; \; \theta = 0 \text{ when} \qquad (2)$$

It is known that according to the shock theory [3, 4], if a piece of cotton has a velocity when it hits$\vartheta_a$ the column, then if we define it as the velocity after the $\vartheta_a$impact, it is determined based on the recovery coefficient as follows.

$$K_1 = \frac{V_{a1}}{V_a}; \qquad K_2 = \frac{V_{a2}}{V_a}; \qquad (3)$$

where,$K_1, K_2$ is the recovery coefficient of the cotton piece after impact and the recovery factor after the generalized waste piece inside the cotton piece is exposed to the surface of the column.

Figure 2 shows a schematic diagram of the process of hammering a piece of cotton and a total piece of waste containing it$\theta$ into the surface of the grate by sawing it with a circular saw. In this interaction, first of all, in the initial state, a piece $\vartheta_a$of cotton and the total mass of the waste is quickly hit the surface of the grate. Then, depending on their own properties, the dissipative parameters of virginity, the piece of cotton after the return returns at $\overline{U}_{a1}$speed, the piece of waste returns at$\overline{U}_{a2}$speed. If the column is cylindrical, the angle [5, 6, 7] $\theta$is zero. If the grate is made conical, after beating them $\theta$, thepiece of cotton, and the piece of waste will be bent at $\theta_2$ angles relative to the axis of the column (not shown in the drawing). Therefore,the recovery coefficients of cotton and waste particles can be determined using the following expressions [8].

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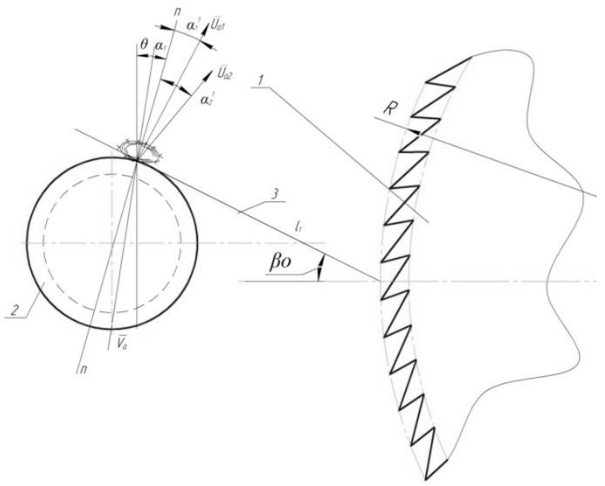


1-saw cylinder; 2-column; 3 pieces of cotton
Figure 2. Scheme of interaction of a piece of cotton and a piece of waste with a chisel.

$$K_1 = \frac{U_{a1} cos\alpha_1^1 cos\theta^1}{V_a cos\alpha_1 cos\theta}; \; K_2 = \frac{U_{a2} cos\alpha_2^1 cos\theta^1}{V_a cos\alpha_1 cos\theta}; \tag{4}$$

where, $U_{a1}$ and $U_{a2}$ are the post-shock velocities of the cotton piece and the waste piece; $\alpha_1^1$ ,$\alpha_2^1$ -angles formed by the normal line of velocities of cotton and waste particles after impact;
$\theta^1 - \overline{U}_{a1}$ and the angles of deflection relative to the axis due to the conical shape of the column. $\overline{U}_{a2}$

It is known that [2, 3] is based on the theory of percussion

$$m (uv) = S \tag{5}$$

where, m is the mass being struck; V-initial velocity, u-post-stroke velocity; S-pulse force.
Therefore, considering (3), (4) and (5), we can write the following.

$$S_n = m_n \omega_б \frac{v_a cos\alpha_1 cos\theta + U_{a1} cos\alpha_1^1 cos\theta^1}{v_a cos\alpha_1 cos\theta} \cdot (R_б + l_1 cos\beta_1);$$

$$S_r = m_r \omega_б \frac{v_a cos\alpha_1 cos\theta + U_{a1} cos\alpha_1^1 cos\theta^1}{v_a cos\alpha_1 cos\theta} \cdot (R_б + l_1 cos\beta_1); \tag{6}$$

$$m = mn + mr$$

here; $m_n$, $m_r$ - masses of cotton and waste pieces, $l_1$ -cotton piece length, m-total mass,

### III. RESULTS

It should be noted that it is important to determine the angle of impact of cotton and waste pieces on the surface of the conical column.
We determined this angle (Fig. 1) using the method of E.F. Budin [8].$\beta$

$$j = j_1 + \frac{(m_n + m_r)\omega_б (R + l_1 cos\beta_1) sin\gamma_1 + S cos\gamma_1}{(m_n + m_r)\omega_б (R + l_1 cos\gamma_1 - S cos\gamma_1)} \cdot$$

$$\cdot \sqrt{cos\left[\frac{S sin\gamma_1 - \omega_б (R + l_1 cos\beta_1)(m_n + m_r)}{(m_n + m_r) l_1 cos\theta}\right] t - 1;}$$

$$\gamma = arccos \frac{cos\theta}{cos\gamma_1} \tag{7}$$

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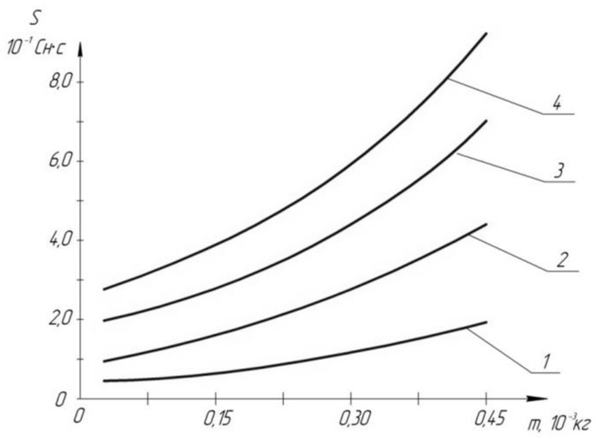
$\theta$=0is obtained in the resulting expression (7), i.e. if a cylindrical column is used instead of a conical column, It follows from the formula proposed by I. F. Budin [8]. In this case, the proposed expression (7) is general, and I.F. Budin's formula is its specific case. In the formula recommended by A. Djuraev and his students [9, 10, 11, 12, 13, 14], pieces of cotton and seeds are not shown separately in the solution of the problem.

## IV. DISCUSSION

Obtained (6) and (7) A series of connection graphs were constructed based on numerical solutions of the expressions. Figure 3 shows the graphs of the dependence of the mass of the cotton piece on the law of change of the value of the pulse impact on the surface of the conical column of the cotton piece. Based on the analysis of the graphs, it can be noted that when the mass of a piece of cotton increases from$0,6 \cdot 10^{-3}$ kg to $0,44 \cdot 10^{-3}$kg, it can be seen that it decreases in a nonlinear32,5 $c^1$ pattern from$0,42 \cdot 10^{-3}$ Sn·s to $2.1 \cdot 10^{-3}$Sn·s when the velocity at which the pulse hits the surface of the conical column is 32.5 s1.




$1 - \omega_б = 32.5c^{-1}; 2 - \omega_б = 36.5c^{-1};$
$3 - \omega_б = 40.5c^{-1}; 4 - \omega_б = 44.5c^{-1};$

**Figure 3. Graphs of the dependence of the mass of a piece of cotton on the mass of a piece of cotton**

Saw drum an increase in the angular velocity will definitely increase the momentum of the cotton swab hitting the surface of the grate. In particular, the momentum of a piece of cotton hitting the surface of the grate when the angular velocity of the saw drum increases$44.5c^{-1}$It can be seen that it increases from $3.12 \cdot 10^{-1}$Sn·s to$9.11 \cdot 10^{-1}$ Sn·s. In general, the smaller the mass of the cotton pieces, i.e. the higher the degree of toughness of the cotton, the more efficient it is to remove the waste. Therefore, when the mass of cotton pieces is in the range of (0.15÷ 0.30)grams, the momentum hitting it on the surface of the conical column is in the range (2.1÷3.5)· $10^{-1} Сн \cdot c$.

It is known that the conical columnar leads to additional displacement of the cotton along the axis of the column. This in turn improves the ginning of cotton. As each conical column has an opposite cone, the movement of the cotton piece changes abruptly, intensifying the separation of the waste. The degree of conicality of the column plays an important role in this. Figure 4 shows graphs showing the effect of a change in the conical angle of a conical column on a change in the momentum of a piece of cotton hitting it. Column conical angle $1.1^o$When increased from $9.05^o$, the impulse force decreases in a nonlinear pattern from 3.15· $10^{-1}$ Сн·с to$1.2 \cdot 10^{-1}$ Сн·с, with the velocity at which the cotton piece is struck to be 5.0 m / s. Hence, it is advisable to make the corneal cone angle larger in order to grind the cotton well. But an increase in the angle leads to a sharp decrease in the n, i.e. the impulse in the stroke to expel the waste inside the cotton may not be sufficient. It is therefore advisable to select the angle of the bell cone in the range$\theta = (5.5^{\circ} \div 8.5^{\circ})$.

The speed at which a piece of cotton is beaten depends mainly on the angular velocity of the saw drum and the length of the piece of cotton. Figure 5 shows graphs of the dependence of the pulse change on the radius of the saw drum on the impact of a piece of cotton on a conical column. Based on the analysis of the graphs, the radius of the saw drum is 0.9· $10^{-1}$m and when 1.82· $10^{-1}$m, we can see that the$\theta = 3^{\circ}$ momentum of a piece of cotton hitting the surface of a conical column increases in a nonlinear pattern from 0,3 $\cdot 10^{-1}$ Сн · с to 3,71· $10^{-1}$ Сн·с. That is, the larger the radius of the saw cylinder, the greater the velocity of the stroke, and accordingly

ISSN: 2350-0328
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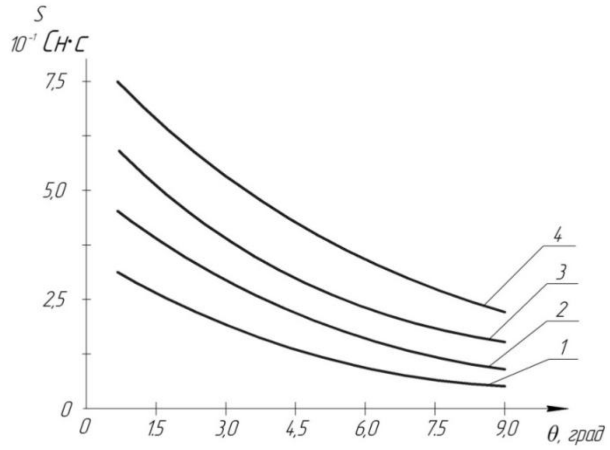
the values of. When the conical angle of a conical column is taken as a conical angle, the values of are found to increase in a nonlinear pattern from $1.1 \cdot 10^{-1}$ Сн·с to $7.43 \cdot 10^{-1}$ Сн·с. In this case, the excessive radius of the saw cylinder leads to an increase in its mass, moment of inertia. This can lead to a number of negative consequences. Therefore, it is advisable to choose not to exceed the radius of the saw drum (0.18) m to ensure that the force pulse $(2.1\div 3.5)10^{-1}$Сн·с does not exceed $(0.18\div 0.22)$ м to reduce seed and fiber damage in the cotton piece [12, 13].

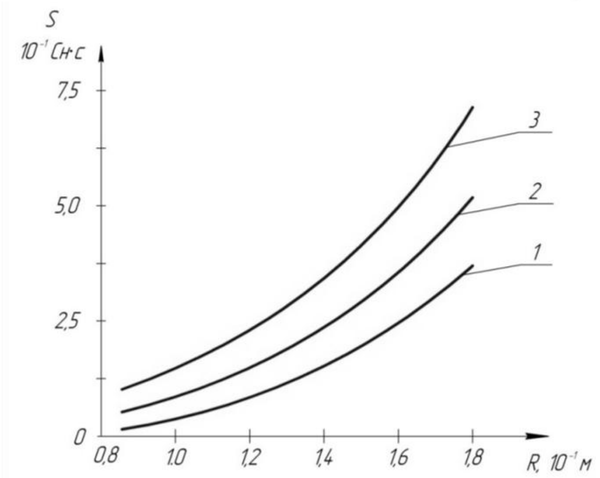
In the technology of cleaning cotton from large wastes, it is important to choose the right angle of deflection after the impact of a piece of cotton with a grate. Figure 6 shows graphs of the angle of inclination of a piece of cotton depending on its mass. The analysis of the obtained graphs showed that when the mass of the cotton pieces increases from $0.06 \cdot 10^{-3} \kappa g$ to $0.44 \cdot 10^{-3}$kg and the angle of the columnar taper is 4.5, the angle of inclination of the cotton piece decreases from $6.21° \cdot 10$ to $5.41° \cdot 10$ in nonlinear regularity. This is because as the mass increases, the angle of deflection decreases accordingly after it is exposed to the column.

Also the pitch cone angle is $3.0^{0}$ the angle of inclination of the cotton piece decreases from $6.49° \cdot 10$ to $5.81° \cdot 10$. When the angle of the cone is zero, that is, in the cylindrical case (based on the formula of E. F. Budin [8]), the angle of inclination of the cotton piece decreases from $70^{o}$ to $64.1^{o}$. This means that an increase in the deflection angle slows down the movement of the cotton piece, increasing the damage to the seed and fiber. Therefore, it is recommended that the mass of the cotton piece be sufficiently crushed to provide a deflection angle $(52° \div 60^{\circ})$ in the range $(0.15\div 0.30)\cdot 10^{-3}$ kg.




$1\text{-}\upsilon_a = 5.0\, м/с$; $2\text{-}\upsilon_a = 6.0\, м/с$;
$3\text{-}\upsilon_a = 7.0\, м/с$; $4\text{-}\upsilon_a = 8.0\, м/с$

**Figure 4. Graphs of the dependence of the pulse of the impact of a piece of cotton on a conical column on the angle of the conical column**




$1-\theta = 3.0^{\circ}$; $2-\theta = 4.5^{\circ}$;
$3-\theta = 6.0^{\circ}$;

**Figure 5. Graphs of the dependence of the change of the pulse of the impact of a piece of cotton on a conical column on the radius of the saw drum**

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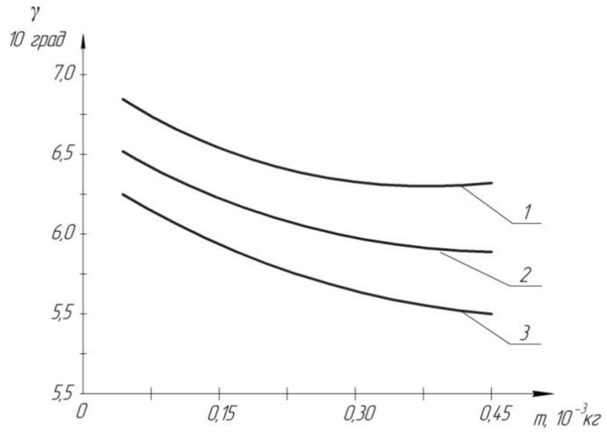
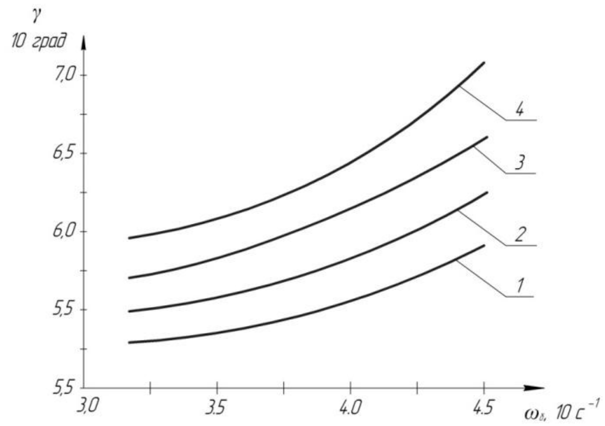



**1-E. F. According to the formula of Budin [8] (cylindrical column)**
**At the 2nd column cone$\theta = 3.0^{\circ}$**
**At the 3rd column cone$\theta = 4.5^{\circ}$**
**Figure 6. Graphs of the angle of inclination of a piece of cotton depending on its mass**




$1 - R_{б} = 1.35 \cdot 10^{-1} M;$
$2 - R_{б} = 1.5 \cdot 10^{-1} M;$
$3 - R_{б} = 1.70 \cdot 10^{-1} M;$
$4 - R_{б} = 1.9 \cdot 10^{-1} M;$

**Figure 7. Graphs of the dependence of the angle of inclination of the cotton piece on the angular velocity of the saw drum**

It is known that the momentum of a piece of cotton hitting the surface of the grate increases sharply with increasing angular velocity of the saw drum [12, 13].

At the same time, the angle of inclination of the cotton piece increases accordingly. Figure 7 shows graphs of the dependence of the deflection angle of a cotton piece on the angular velocity of the saw drum. The saw speed of the drum is 32.5 $c^{-1}$ c increases from 45 $c^{-1}$ when the angle of inclination of the cotton piece increases from 53° to 60.5°m when the nonlinear regularity is $R_{б} = 1.35 \cdot 10^{-1}$m. However, when the radius of the saw drum is multiplied by 1.9$\cdot 10^{-1}$, the deflection angle of the cotton piece is from 59$^{0}$to 72.5$^{0}$was found to increase to. Based on the analysis, it is recommended that the sawing drum angular velocity (3.5÷ 3.8)10$c^{-1}$be in the range of 10s-1 and its radius (1.5÷ 1.75)$10^{-1}$ mbe in the range of 10-1m to ensure that the cotton piece has a deflection angle (52° ÷ 60°).

## V. CONCLUSION

The article considers the impact of impact of cotton pieces with conical column cleaners for cleaning large contaminants theoretically, based on the results of the analysis of the connection graphs of the parameters. The formula for determining the pulse of impact of a piece of cotton on the surface of a conical column is proposed.

The smaller the mass of the cotton pieces, i.e. the higher the degree of toughness of the cotton, the more efficient it is to remove the waste. Therefore, when the mass of cotton pieces is in the range of (0.15÷ 0.30) grams, the momentum hitting it on the surface of the conical column is in the(2.1÷3.5)$\cdot 10^{-1} Сн \cdot c$ range.

the impulse to strike to expel the waste inside the cotton may not be sufficient. It is therefore advisable to select the angle of the bell cone in the $\theta = (5.5^{\circ} \div 8.5^{\circ})$ range.

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To reduce the damage to the seed and fiber in the cotton piece, it is advisable to choose not$(2.1\div 3.5)10^{-1}$ Сн·с to exceed the radius of the saw drum $(0.18\div 0.22)$m to ensure that the force pulse does not exceed.

An increase in the angle of inclination slows down the movement of the cotton piece, increasing the damage to the seed and fiber. It is therefore recommended that the mass of the cotton piece be sufficiently crushed to provide a deflection angle $(52^\circ \div 60^\circ)$ in the range $(0.15\div 0.30)\cdot 10^{-3}$kg.

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