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CREATING A MATHEMATICAL MODEL OF MOVEMENT IN THE PROCESS OF CLEANING COTTON FROM DIRT

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ABSTRACT

This article suggests a mathematical model of the movement of cotton fiber on the surface of a separative cleaning cotton seeds. This technology describes profoundlyl the natural state of the cotton seeds being cleaned, and the mathematical appearance of the movement, taking into consideration the forces that affect the cotton fiber during cleaning.

KEYWORDS: *cotton ginner, lattice surface, dirt chamber, refined cotton chamber, friction surface on net surface, movement of cotton piece on colored surface, velocity of cotton slices on the surface, integration, weight force, normal reaction force, differential equation of movement of a piece of cotton on a net surface.*

INTRODUCTION

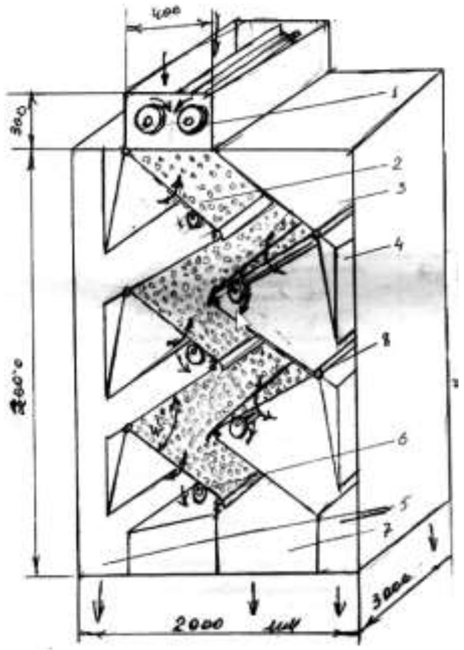
Today, the development of the society puts the important tasks of cotton processing, improvement of existing techniques and technologies in the field of production of high quality fiber that meets international standards. In its position, the improvement of spinning and weaving equipment also indicates the need to pay special attention to the quality of cotton fiber.

By scientists Ataullaev A.Kh. and Ravshanov N, the research work was conducted mainly in a separative way, with theoretical and practical research on the technological process of cotton sowing [1,8].

The research by R.Muradov, A.Karimov, E.Tadayeva, Z.Abdukhakharov and M.Ismanov mainly focuses on the "Separation of dirty particles in the raw cotton particles moving on the surface with curved contours". In this work, a theoretical study of the mechanical (shock) release of large and small impurities in the raw cotton raw materials was performed to determine the amount of fibers emitted from the purification zone [2,3,7,9,10,11].

In addition to the mentioned sources above, our research has focused on the fact that major contaminants in cotton less or hooks in the raw cotton, however minor impurities are deeply embedded in the raw cotton. The removal and separation of such minor contaminants from the cotton, which, in turn, requires sophisticated vibration (horizontal and vertical vibration) and, necessitates the development of a new device with sloping surface surfaces.

This vibration-proof cotton gin was designed by us and shown below (Figure 1).



1. Movement Provider
2. Flat surface (in vibration motion)
3. Protective and Referring Surface
4. Protective surface
5. Dirty camera
6. Headphones (ellipsoids move full surface)
7. Purified Cotton Drop chamber

Figure 1. Cotton cleaning equipment.

The process of cleaning cotton in this unit is as follows.

In this device, patches are cleaned using a completely new technology - a separator (based on the method of passing cotton seeds through a series of surfaces). Separation is supposed to maximize the use of the lattice surface to prevent impurities, that is, the first piece of cotton to be applied to the protective surface (4) before moving it to the surface; reverses direction.

In the next process, the cotton swab passes through the 3-4-5-6 coils of the device and is collected into a purified cotton dropper chamber (7) and transferred to the desired location. During the separation, the impurities in the cotton seeds are removed from the device by a special camera (5).

This device not only removes minor impurities in the cotton, but also improves the level of cotton sludge. As a result, the natural condition of fibers and seeds remains and their quality is improved.

MATHEMATICAL MODEL OF MOVEMENT OF A COTTON SLIP ON A FLAT SURFACE

We draw the following line to develop a mathematical model of the cotton swab that runs along the surface of the unit (2) during the survey (Figure 2).

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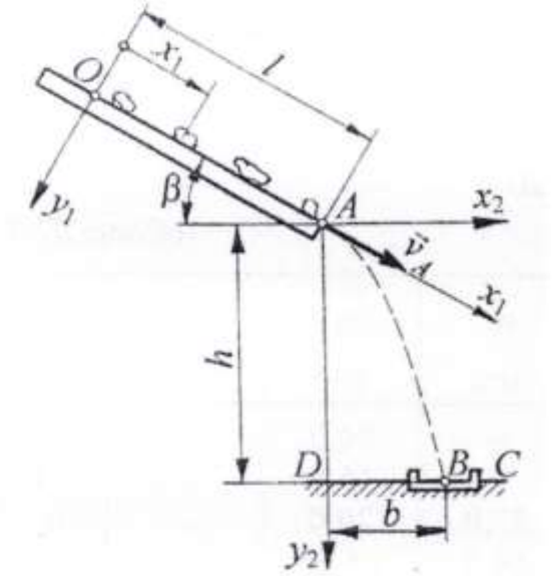

Figure 2.

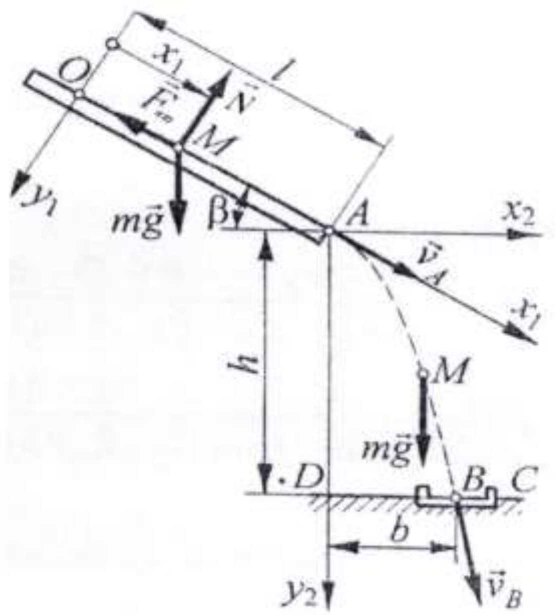

Figure 3.

The OA surface of the entire surface of the cotton gin is a sloping plane, forming a β angle with a horizontal plane. On the strip surface The cotton barrel began to move peacefully (point O) and A shot at v_A point and speed (Figure 2).

The coefficient of slip friction of a strip surface is equal to f. Considering the cotton spots as a material point and not taking into account the air resistance, we can determine the time at which the cotton swab has been moved from the start to its full surface and the speed of the h fall.

The OA of a cotton swab is on its way to the plains The following forces are affected: gravity mg, normal reaction force Friction force on the N and slip Fish (Figure 3) OX_1 axis, with a sloping trajectory of cotton slopes Let's create a differential equation of motion:

$$m\ddot{x}_1 = \sum_{k=1}^{3} F_{kx_1} \qquad (1)$$

$$m\ddot{x}_1 = mg\sin\beta - F_{ish}$$

Here:

$$F_{ish} = f\,N \qquad N = mg\cos\beta \qquad (2)$$

(2) The equation: (1) If we take it to:

$$m\,\ddot{x}_1 = mg\sin\beta - fmg\cos\beta$$

$$\ddot{x}_1 = g(\sin\beta - f\cos\beta) \qquad (3)$$

(3) We integrate it twice:

$$\frac{d v_{x_1}}{d t_1} = g(\sin\beta - f\cos\beta)$$
$$d v_{x_1} = g(\sin\beta - f\cos\beta) dt_1$$

We integrate:

$$\int d v_{x_1} = \int g(\sin\beta - f\cos\beta) dt_1$$

We can take this result by integrating it once:

$$v_{x_1} = g(\sin\beta - f\cos\beta)t_1 + C_1 \quad (4)$$

$$v_{x_1} = \frac{dx_1}{dt_1} \quad (5)$$

We integrate again by putting (5) to (4):

$$\frac{dx_1}{dt_1} = g(\sin\beta - f\cos\beta)t_1 + C_1$$
$$dx_1 = [g(\sin\beta - f\cos\beta)t_1 + C_1]dt_1 \quad (6)$$
$$\int dx_1 = \int [g(\sin\beta - f\cos\beta)t_1 + C_1]dt_1$$
$$x_1 = g(\sin\beta - f\cos\beta)\frac{t_1^2}{2} + C_1 t_1 + C_2$$

integral variables S1, S2 into equations (4) and (6) Let's set the initial values of the variables: Initial values: $x_1(0) = 0$ at $t_1 = 0$; $v_{x1}(0) = 0$ The result is:

$$v_{x_1}(0) = C_1 = 0$$
$$x_1(0) = C_2 = 0$$

The following equations are:

$$v_{x_1} = g(\sin\beta - f\cos\beta)t_1 \quad (7)$$
$$x_1 = g(\sin\beta - f\cos\beta)\frac{t_1^2}{2} \quad (8)$$

Cotton slices t1 sec to pass through OA. If time goes by, In equations (7) and (8), $v_{x1}=v_A$ and; $x_1 = l$.

Thus:

$$v_A = g(\sin\beta - f\cos\beta)t_1$$
$$x_1 = l = g(\sin\beta - f\cos\beta)\frac{t_1^2}{2} \quad (9)$$

(9)The equation of the OB from the equation.

$$t_1 = \frac{v_A}{g(\sin\beta - f\cos\beta)} \quad (10)$$

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We will now examine the movement of the cotton barrel in the AB. At this point, the cotton slip is only affected by its weight. The differential equation of motion is written as follows:

$$m\ddot{x}_2 = 0, \qquad \ddot{x}_2 = 0$$
$$m\ddot{y} = mg \qquad \ddot{y}_2 = g$$

(11)

$\ddot{x}_2 = 0$ We will integrate the equation two times:

$$\frac{dv_{x_2}}{dt_2} = 0; dv_{x_2} = 0; v_{x_2} = C_3; \quad (12)$$

$$\frac{dx_2}{dt_2} = C_3; dx_2 = C_3 dt_2; \int dx_2 = \int C_3 dt_2; x_2 = C_3 t_2 + C_4 \quad (13)$$

Initial preconditions for the movement of cotton linter AB are:equal to $t_2 = 0$ da $x_2(0) = 0$, starting speed A_{x2} projection in equal to o $v_{x2}(0) = v_A \cos\beta$. Adding these values to equations (12) and (13), we find the integral variables:

$$C_3 = v_A \cos\beta; C_4 = 0$$

Thus:

$$v_{x_2} = v_A \cos\beta \quad (14)$$

$$x_2 = v_A t_2 \cos\beta \quad (15)$$

Afterward $\ddot{y}_2 = g$ We will integrate the equation two times:

$$\frac{dv_{y_2}}{dt_2} = g; dv_{y_2} = gt_2; \int dv_{y_2} = \int g dt_2; v_{y_2} = gt_2 + C_5; \quad (16)$$

$$\frac{dy_2}{dt_2} = gt_2 + C_5; dy_2 = (gt_2 + C_5)dt_2; \int dy_2 = \int (gt_2 + C_5)dt_2; y_2 = \frac{gt_2^{\,2}}{2} + C_5 t_2 + C_6 \quad (17)$$

To determine the integral variables C5, C6, we use the initial conditions:

$t_2=0$ da $y_2(0)=0$; $v_{y2}(0)=v_A\sin\beta$ (18)

(18) terms Let's take it (17):

$$C_5 = v_A \sin\beta; C_6 = 0 \quad (19)$$

Then:

$$v_{y_2} = v_A \sin\beta + gt_2 \quad (20)$$

$$y_2 = v_A t_2 \sin\beta + \frac{gt_2^{\,2}}{2} \quad (21)$$

(21) Given that $y_2 = h$ in the equation, the cotton swab Determine the time t_2 takes to get through AB:

$$h = v_A t_2 \sin\beta + \frac{g t_2^2}{2}; \quad (22)$$

OB Time to go through the range:

$$t = t_1 + t_2$$

(14), (20) From the equations, the velocity of cotton fiber for t_2 time A_{x2}, A_{y2} We define the projections in the coordinates of the Moon2:

$$v_{Bx_2} = v_A \cos\beta$$

$$v_{By_2} = v_A \sin\beta + g t_2$$

Calculate the velocity of the cotton barrel at the DC plane (The next is the surface):

$$v_B = \sqrt{v_{Bx_2}^2 + v_{By_2}^2}$$

Using the mathematical model described above, the movement of the cotton slices on the net surface of the cotton gland depends on the movement time and the velocity of the next lattice, the slope of the net surface relative to the horizon and the initial velocity v_A calculations.

CONCLUSION

In our developed mathematical model, we can make several experiments by adjusting the slope angle to find the optimal value so that no slip can be formed on the surface, and its stability on the surface. In this process, due to repetition of the cotton surface on different surfaces, minor impurities are removed from the surface holes and the quality of the cotton is improved.

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