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# *Planting Device*

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**Abstract – In article is given a sowing device with elastic turners of a cotton seeder installed on a section of a single-bar frame of the unit. In this case, an elastic agitator is installed above the feeder-agitator of the sowing device. The length of the tedder rod and its diameter have been determined.**

**Keywords – Opener, Seeders, Bare Or Lowered Cotton Seeds, Sowing Technology, Seed Preparation For Sowing, Working Bodies Of Support-Drive Wheels, Theoretical And Experimental Research Reel, Sowing Device, Number Of Seeds, Bridging Devices.**

## I. INTRODUCTION

The industry of the Republic of Uzbekistan produces seeders equipped with devices for sowing bare or lowered cotton seeds. In connection with the improvement of sowing technology, methods of preparing seeds for sowing, as well as labor productivity requirements during sowing, in recent years there has been a slight update of the fleet of seeders, including cotton. At the same time, the layout of the devices, the working bodies of the support-drive wheels changed, the volumes of the bunkers significantly increased, the conditions for the grasping of the coils of the pubescent seeds by the teeth changed, which required theoretical and experimental studies to select the optimal parameters of the seeding device [1].

The sowing device is one of the most important working parts of the seeder, which serves to select a certain amount of seeds from the total mass and form an initial flow of them with specified parameters.

Therefore, the advantages and disadvantages of seeders in relation to the quality of the distribution of seeds in the row and in the sown field as a whole are mainly determined by the operation of the seeding devices.

## II. Analysis And Results

Analysis of the designs of foreign seeders, for example, models 7000. 500.51 by John Deere (USA), Uzbekb, Gloucester, Stenhay (England), Monodril, Monodril, Monocenter of Feze, "Unicorn", "Ekzakta-Hassia" (Germany), testifies that mechanical seeding devices are widely used for sowing agricultural seeds.

Mechanical (or chemical) processing of poorly free-flowing seeds requires additional labor and funds, the presence of special graters on the farms. In addition, during the processing the seeds are injured, which reduces their germination [2] ..

The use of bridging devices as a means of reducing the adhesion of seeds to each other is the most promising.

A classic design of a sowing device for pubescent soaked cotton seeds, containing a bottom, a toothed agitator-feeder, a toothed seeding wheel, and an adjusting flap, was adopted for research. This apparatus is shown in Figure 2.3.

At the end of the feeder, an axis is installed, on which a spring is fixed, one end abuts against the body of the crown - the feeder, and the other end is free, moving in the mass of seeds and is its own flexible elastic agitator.

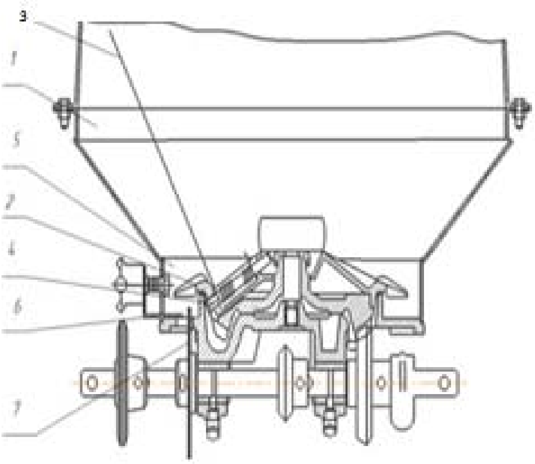


Figure 2.3. experimental sowing device:

*1 hopper; 2-tedder-feeder; 3 – turner; 4 – axis; 5 – bottom; 6 – coil; 7-damper.*

Length of the axis on which the turner spring is located is determined on the basis of the dimensions of the crown - the feeder structurally. According to the diameter of the crown-feeder ($d_п$ = 220 mm), the length of the spring is taken equal to $I_{пр} \leq 50$ mm

Tedder shaft, during its movement, experiences pressure from both sufficiently densely packed seeds, as well as loose ones, which depends on the methods of backfilling and the method of preparing the seeds for sowing (moistening, languishing). Therefore, its fluctuations will have a variational character [3].

Let us consider the movement of the turner rod based on the system for determining the bending of a cantilever elastic rod, while the model of the system under consideration includes [4]:

1. A model elastic bar with a mass intensity defined as

$$\frac{\pi d^2 \gamma_c}{4g} \cdot \frac{d^2 U}{dt^2}; \qquad (1)$$

Where d is the diameter of the rod, m:

ɤ - density of the rod material in kg / m$^3$;

g – acceleration due to gravity in m / s$^2$

In this case, the first term is the mass of a unit length of the rod, and the second is a function of dynamic acceleration.

1. Bending stiffness of the bar is determined according to the expression:

$$EJ = E\frac{\pi d^4}{64}; \qquad ; \qquad (2)$$

and the distributed elastic force:

$$F_{упр} = EJ\,\frac{d^4Y}{dZ^4}; \qquad (3)$$

Where $\frac{d^4Y}{dZ^4}$ – the fourth partial derivative with respect to the length of the rod in the section under consideration.

2. The generalized coordinate taking into account the dynamic bending U (t, Z) is a function of time t and the coordinates of the section under consideration Z.

3. The intensity of the external force, ie the variability of the impact of seeds on the rod q (t, Z) (N / m).

This function is characterized by dependence on time, for which we consider the pressure from the weight of the seeds on the wall of the hopper and the turner [5].

Based on the above, we obtain the following differential equation:

$$\frac{\pi d^2\gamma_c}{4g}\cdot\frac{d^2U}{dt^2} + EJ\,\frac{d^4U}{dZ^4} = \left(q_1\sin\frac{\pi Z}{2I_o} + q_2\sin\frac{\pi Z}{I_o}\right)\left(1 - \cos\frac{2\pi t}{\tau_B}\right) \qquad (4)$$

We find a solution to the problem by designating

$$\mu = \frac{\pi d^2\gamma_c}{4g}\ (\text{kg}\cdot s^2/\text{m}^2); \quad C^2 = \frac{EJ}{\mu}; \quad q_m = \frac{q_1}{\mu}.$$

Then the equation for the first mode of vibration takes the form $\frac{d^2U_1}{dt^2} + C^2\frac{d^4U_1}{dZ^4} = q_m\sin\frac{\pi Z}{2I_o}\left(1 - \cos\frac{2\pi t}{\tau_B}\right)$.

(5)

Then

$$Umax = \frac{2q_m\sin(\pi Z/2I_o)}{a^2}\ (m) \qquad (6)$$

Given some constructive values of quantities and previously determined, the values of the function for $1_0$ = 150; 200 and 250 mm and from there we will preliminarily determine the diameter of the turner rod.

Working of the rod-turner can occur under various conditions, when the rod is subjected to a sudden concentrated load, evenly distributed and constant, etc. We believe that from the point of view of long-term operability of the agitator rod, the calculation must be made from the condition of a suddenly applied concentrated load at the free end of the agitator (Figure 2.7).

Concentrated load Pq is calculated according to the equation

$P_q = q_l\,h_l = 337{,}5 \cdot 0{,}016 = 5{,}4$ H,

Where $q_l = H_б \cdot 1_0 \cdot g \cdot \gamma_{сем} = 0{,}5 \cdot 0{,}15 \cdot 10 \cdot 450 = 337{,}5$ N/m;

$H_б$ – seed hopper height, m;

$1_0$ - rod length, m;

$h_l$ – loosening layer height, $h_l = 0{,}016$ m.

The torque of this force will be

$M_p = h_p \cdot Pq = 0{,}15 \cdot 5{,}4 = 0{,}81$ N· m,

Where

$h_p$ – distance from the axis of rotation to the point of application of the force, $h_p = 0{,}15$ m.

$$d=\sqrt[3]{\frac{M_p \cdot K}{0{,}1/[\tau]}} \tag{7}$$

Where $K = 1{,}28;$

$[\tau]$ - permissible torsional stress, $[\tau] = 0{,}45$ Mpa.

For bar length $l_{01} = 150$ mm

$D_1 = 2{,}8$ mm,

and when $l_{02} = 200$ mm and $l_{03} = 250$ mm accordingly

$d_2 = 3{,}1$ mm and $d_3 = 3{,}38$ mm.

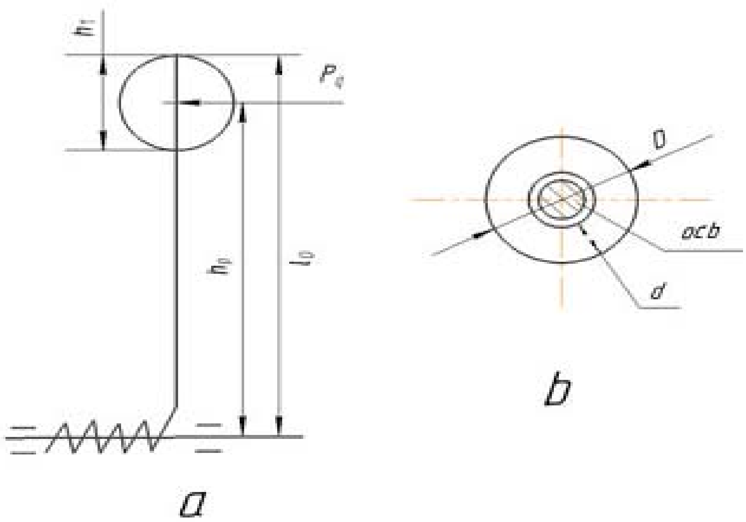


Figure 2.7. Scheme for calculating the diameter of the rod and the spring of the agitator

*a)side view; b) spring profile.*

Now, by the product of the calculation of the bar from the condition of the maximum vibration amplitude of the end of the bar, using the expression

$$Umax = \frac{2q_m}{a^2} sin \frac{\pi Z}{2I_o}, \text{ m} \tag{8}$$

where

$$2q_m = \frac{2q_1}{\mu}, \frac{M}{C^2};$$

$$a^2 = c^2 \frac{\pi^4}{16 {I_o}^4} = \frac{EJ\pi^4}{\mu 16 {I_o}^4}, \frac{1}{C^2}.$$

Then

$$Umax = \frac{125 \cdot q_1 \cdot {I_o}^4}{\pi^4 E \cdot {d_o}^4}. \tag{9}$$

where $l_0 = 150$ mm,

we get

$$d_o = \sqrt[4]{\frac{5,39}{10^{12} \cdot I_o}} \text{ m}$$

From here

$$d = \sqrt[4]{5,39/(0,150 \cdot 10^{12})} = 0,00245 \text{ m.}$$

or 2,45 mm.

Thus, according to the conducted theoretical studies, to ensure sufficient rigidity of the rod for further research, we accept springs with a diameter of d = 2.45 ... 3.0 mm.

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