

**DESCRIPTION OF THE STRUCTURE AND WORKING PROCESS OF A MACHINE FOR PREPARING SOIL FOR SOWING SMALL SEEDS**

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**Annotation**

This article provides information on the structure of the machine for preparing the soil for sowing small seeds, its operation, its aggregation with the tractor base, what sections it consists of, and the parameters of the machine's loosening equipment.

**Keywords**

roller, rod, arrow-shaped paw, rod working body, mounting device, sowing, seed, hinge, frame, soil.

The machine for preparing the soil for sowing small seeds (hereinafter referred to as the machine) is designed to consist of a frame equipped with a mounting device, arrow-shaped paws mounted on it, a rod roller, and rods (Figure 1.1). The arrowheads are fixed to the frame in a staggered arrangement in two rows rigidly (stationarily), while the rod rollers and rods are hinged.

In the process of work, the machine's arrow-shaped paws loosen the soil to a depth of 10-16 cm, the rod roller and rod working bodies crush, level, compact the surface part of the layer loosened by the arrow-shaped paws, and form a fine soil layer on it.

**Studied parameters of the working bodies of the machine**

The studied parameters of the machine's working bodies are as follows (Fig. 1.2).

a) by arrow-shaped paws:

$2\gamma_p$  - angle of opening of the wings of the arrow-shaped paw, °;

$\beta_p$  - crumbling angle of the wings of the arrow-shaped paw, °;

$\alpha_p$  - angle of penetration of the arrow-shaped paw into the soil, °;

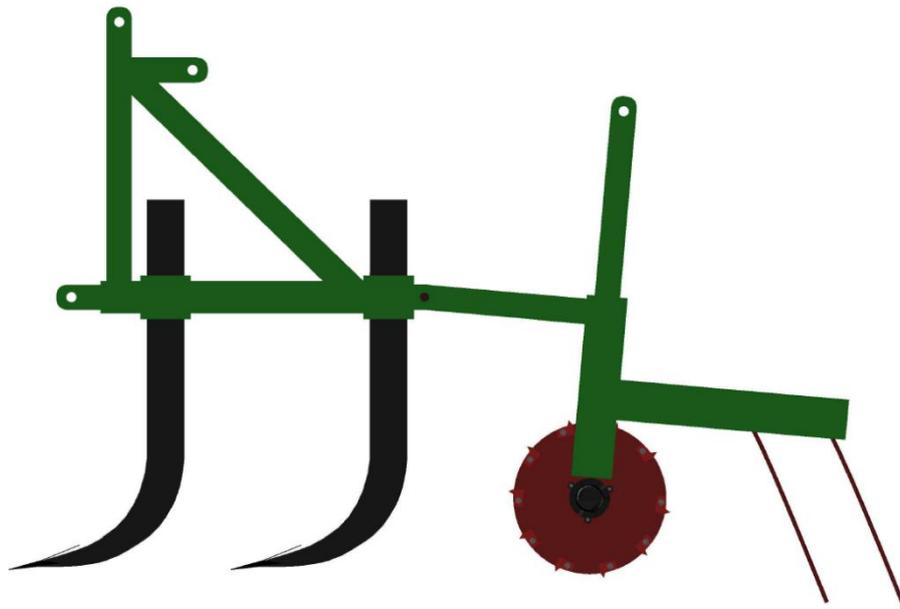
$bq$  - arch grip width, m;

$b_k$  - transverse distance between arrow-shaped paws, m;

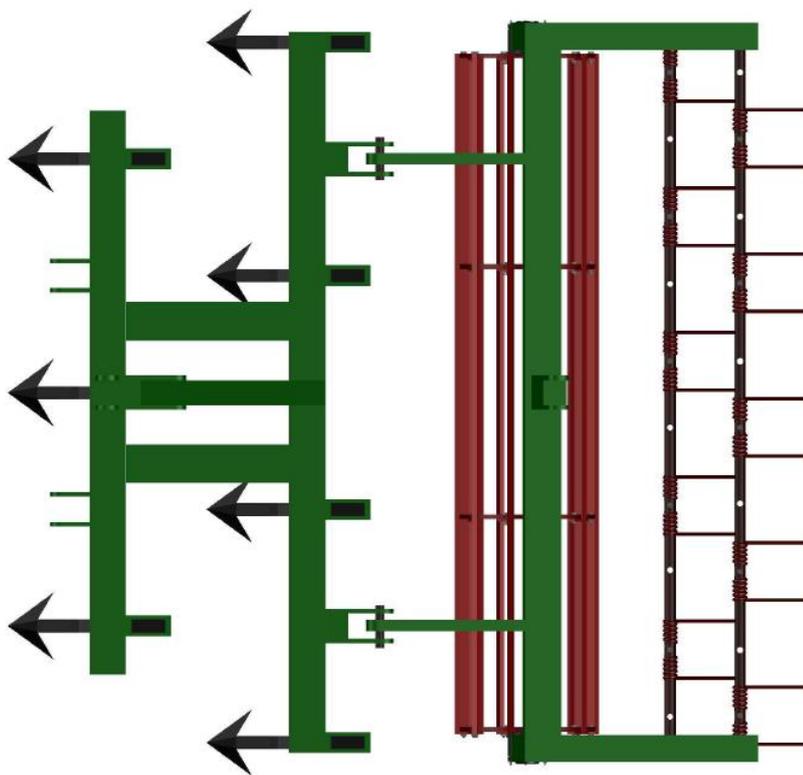
$L_b$  - longitudinal distance between the arrowheads, m.

b) on the rod roller:

$D_p$  - diameter of the rod roller, m;



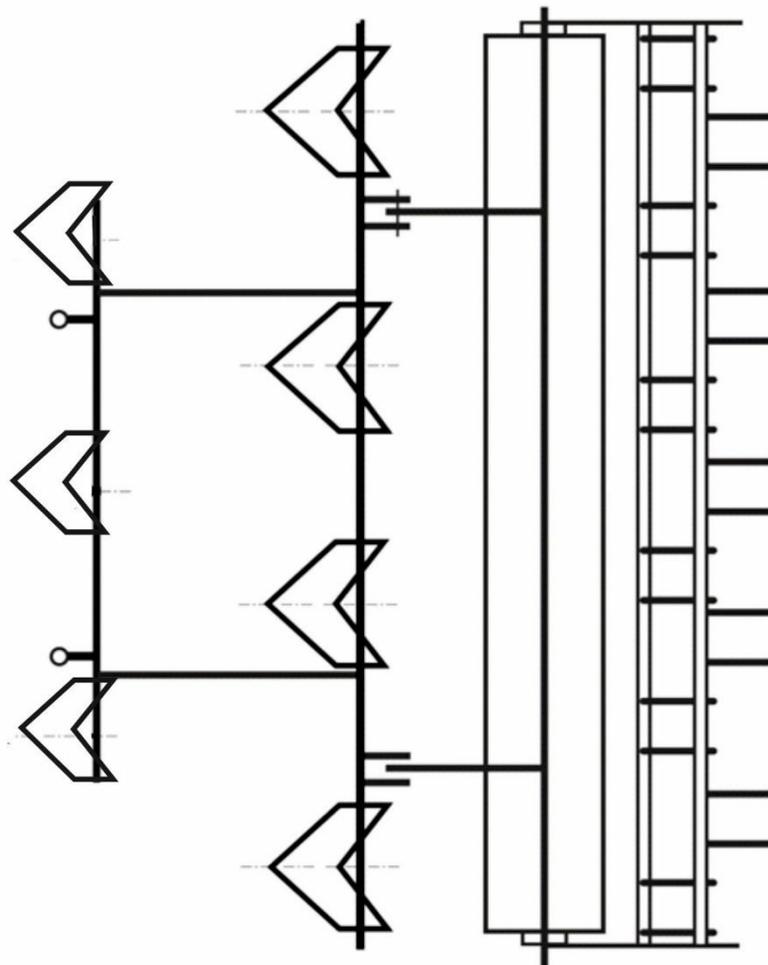
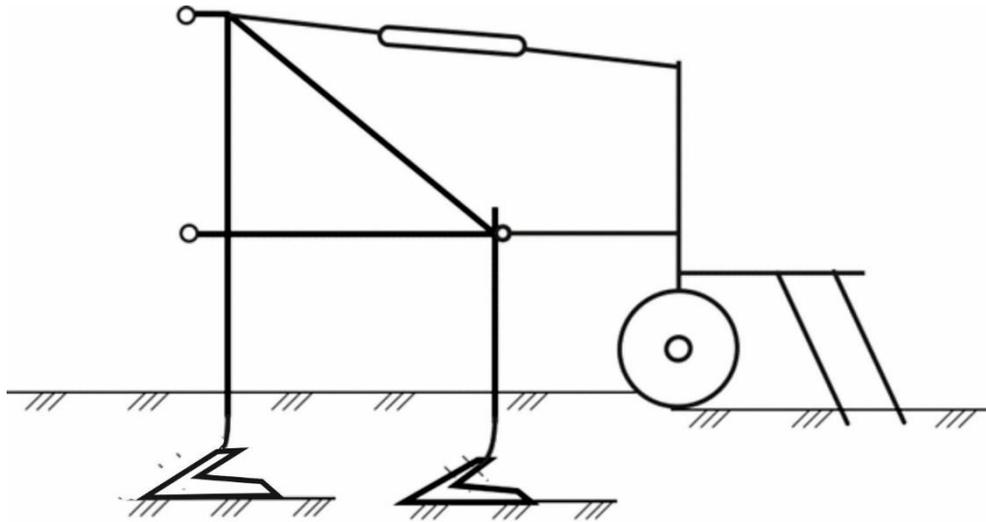
a)



b)

a) side view; b) top view

**Figure 1.1. Structural diagram of the machine.**



a) side view; b) top view

**Figure 1.2. Study of the working bodies of the machine  
Parameters**

$n_p$  - number of rods installed on the roller, units;

$\varepsilon$  - angle of installation of the rods relative to the axis of rotation of the roller, °;

$Q_p$  - vertical thread fed to the rod roller, N.

c) for the rod working body:

$d_{ch}$  - rod diameter, m;

$l_{ch}$  - rod length, m;

$a_i$  - width of the rod tracks, m.

These parameters were previously studied by A.Tukhtakuziev, K.B.Imamkulov, B.U.Tashpulatov, I.I.Abdimominov, I.A.Inoyatov, U.P.Boboev, M.T.Mamrasulova, G.K.Eshmatova, and others [1-8].

#### Determination of the parameters of machine arrowheads

The angle of opening of the wings of the arrow-shaped paw is determined by the following expression from the condition of ensuring free sliding along plant residues, weeds, and soil particles, their working surfaces, and blades [Klenin Sakun; p. 79)

(1.1)

or

(1.2)

where  $\varphi_b$  - arrow-shaped remnants of plants, weeds and their roots

angle of friction of the paw wings against the working surface and blade, °;

$\varphi_1$  - on the working surfaces and bottoms of the wings of the arrow-shaped paw of the soil

angle of friction, °;

In calculations according to formulas (1.1) and (1.2), whichever of the angles  $\varphi_b$  and  $\varphi_1$  is greater is taken.

In most cases  $\varphi_b > \varphi_1$  [Sinyakov, Panov, p. 189]. Taking this into account, we write expressions (1.1) and (1.2) as follows

(1.3)

or

(1.4)

Accepting  $\varphi_b=30^\circ-35^\circ$  for the conditions of our republic [75 literature from Nurabaev; 49-55-b.], according to expressions (1.3) and (1.4), we determine that  $2\gamma_p=55^\circ-60^\circ$  and  $\gamma_p=27^\circ30'-30^\circ$ .

The crumbling angle of the arrow-shaped paw is determined from the condition of high-quality loosening of the soil of the layer it processes with minimal energy consumption according to the following expression.

$$\beta_p = \arcsin \left[ \sin(\varphi_1 + \varphi_2) + \left\{ \sin^2(\varphi_1 + \varphi_2) + \right. \right.$$

$$\left. \left. + 2 + \frac{1}{2} \cos(\varphi_1 + \varphi_2) \right\}^{1/2} \right] \cdot \left[ 1 + \cos(\varphi_1 + \varphi_2) \right]^{1/2} :$$

(1.5)

where  $\varphi_2$  - angle of soil friction with the soil, °.

According to the data provided in the literature [Literature 70 of Nurabaev, p. 16, Literature 88 of Nurabaev, p. 14-18], assuming  $\varphi_1=25^\circ-30^\circ$  and  $\varphi_2=40^\circ-45^\circ$ , according to expression (1.5), we determine that the crumbling angle of the machine's arrow-shaped paws should be within  $25^\circ-32^\circ$ .

The angle of penetration of the arrow-shaped paw into the soil is determined using the following expression based on the known values of the angles of opening and crumbling of the wings. [Sinyakov, Panov, p. 193].

(1.6)

Substituting the above-determined values of  $\gamma p$  and  $\beta p$  into this expression, we determine that the angle of entry of the machine's arrow-shaped paw into the soil is  $12^\circ-17^\circ$ .

The working width of the arrow-shaped paws is determined by the following expression from the condition that the arrow-shaped paws located in the second row of the machine operate under the condition of full open cutting [mon. To'xtaqo'ziyev, Imomqulov, p.32.

$$b_q = 2\sqrt{\frac{p^2 a^2 - (pa - m)^2}{4}} + \frac{1}{64} p^2 c - 4 (pa - m)^2 +$$

, (1.7)

where; (1.8)

(1.9)

(1.10)

(1.11)

$q_o$  - coefficient of volumetric crushing of soil cultivated by arrow-shaped paws, N/m<sup>3</sup>;

$k_c$  - specific compressive strength of the soil, processed by arrow-shaped paws, Pa.

$h$  - processing depth of the bow-shaped tine, m.

If condition (1.7) is not met, i.e.,  $b_q$  is greater than the right side of expression (1.7), the arrow-shaped paws in the second row are used under partially open cutting conditions. As a result, the tractive resistance of the machine increases and the quality of soil crumbling decreases (due to the formation of large clods).

[Sinyakov, Panov, p. 121] and  $k_c = 2 \cdot 10^4$  Pa (Mon. Tux. Imam. 47-b.) and taking  $h = 0.16$  m and substituting the above-determined and given values for  $\gamma p$ ,  $\beta p$ ,  $\varphi_1$  and  $\varphi_2$ , we determine that the reach width of the arrow-shaped paw can be no more than 26 cm. As the final result, we accept the reaching width of the arrow-shaped paw as 24 cm.

The transverse distance between the arrow-shaped paws is determined by the following expression from the condition of complete loosening of the layer being processed by them and complete loosening of weed roots according to the scheme in Figure 1.2.

, (1.12)

where  $\Delta b$  - arrow-shaped paws located in the first and second rows

width of wing overlap, m.

Substituting the above-defined value of  $b_q$  into expression (1.12) and assuming  $\Delta b=0.04$  m [Sinyakov, Panov, p.193], we determine that the transverse distance between the arrow-shaped paws should be 20 cm.

The longitudinal distance between the arrow-shaped paws is determined using the scheme shown in Figure 1.3 from the condition that soil, plant residues, and weeds do not get stuck between them. For this condition to be met, the zone of propagation of soil deformation in the longitudinal direction under the action of the right wing of the arrow-shaped paw located in the

second row, as shown in the diagram in Figure 1.3, should not reach the left wing of the arrow-shaped paw located in the first row. Based on this, we have the following in Figure 2.3:

, (1.13)

where  $l_u$  - length of the arrow-shaped paw, m;

$k_y$  - soil, plant residues, and weeds located in the second row

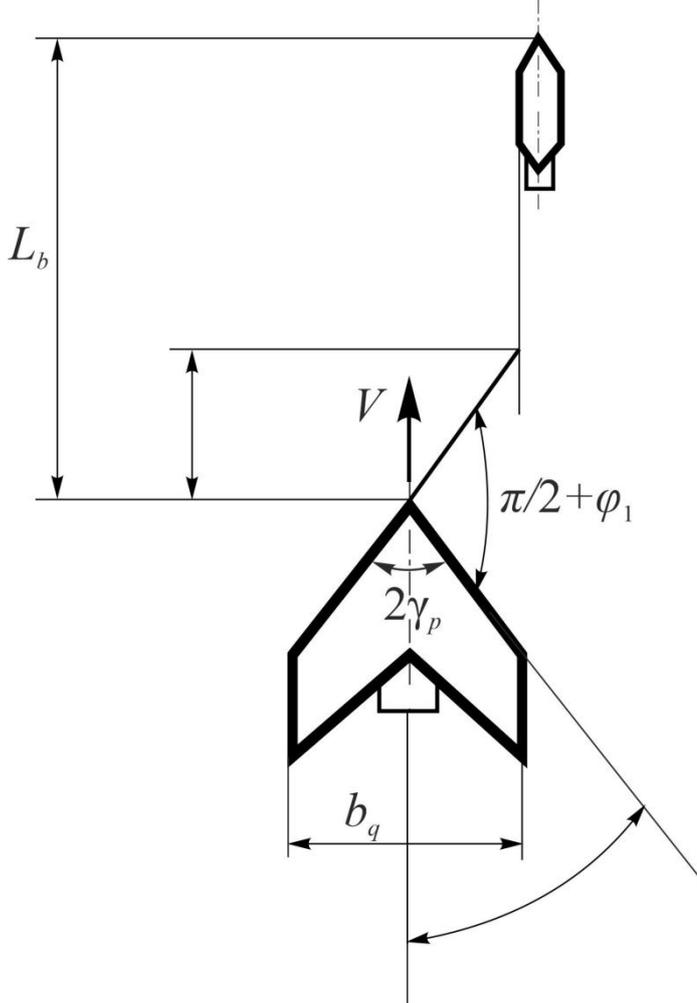
taking into account the accumulation in front of the arrow-shaped paw

coefficient.

according to the diagram in Figure 1.3

, (1.14)

where  $b_{\min}$  - minimum width of the arrow-shaped paw wing, m.



**Figure 1.3. Diagram for determining the longitudinal distance between the arrow-shaped paws of a machine**

Substituting (1.14) into (1.13), we obtain:

. (1.15)

Taking  $k_y = 1.5$  and  $b_{\min} = 0.05$  m [Sinyakov, Panov, p.191] and  $b_q, \gamma_p, \beta_p, \alpha_p, \Delta b$  and  $\varphi_1$ , we determine that the longitudinal distance between the arrow-shaped paws of the machine according to expression (1.15) should be at least 50.5 cm .

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