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# Substantiation of Parameters of Working Body of the Combined Unit for Repeated Crops

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**ABSTRACT**

In article the substantiation technological and design data depth of immersing, a corner of a point of a disk, diameter of a disk of the adaptation to a general purpose plough is considered.

**Keywords:** a disk, the plough case, a corner of a point of a disk, diam

**Introduction**

At present, traditional methods are often used to prepare the fields free of grain for replanting, ie after the harvest, the fields are plowed, then the irregularities created by plowing with GN-2,8 or GN-4 levelers are leveled and then the soil is chiseled. 8 or MV-6.5 is being treated with levelers fields to reduce costs and maintain soil moisture. One of the important tasks is to develop a device for plowing to prepare for planting, with additional processing, and to justify the dimensions of the working parts of the unit.

The combined unit consists of roller and soft layer forming plates equipped with cuneiform working surface disks, equipped with leveling, compacting working parts (Fig. 1).

The combined unit works as follows: the disks rolled by the plow bodies are first affected by a disc roller, which crushes and compacts the disks, and shredders. This increases costs, a decrease in soil moisture, a violation of its structure, a prolongation of planting time. Based on the above considerations and the analysis of the literature and the results of preliminary experiments, plowing, tillage, and agro-technical measures can be combined with irrigated plowing of vacant grain then the leveler - the leveler of the compactor flattens the plowed surface, its compactor is compacted to the required level. After that, the plates are exposed to the soil, forming a soft layer to collect moisture on the plowed surface.

**Main part**

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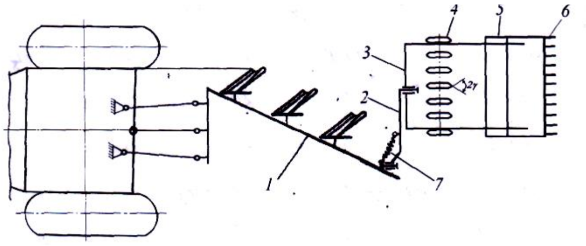
The combined plug device is mounted on a mounting-inverting plug, which is widely used in agriculture.




The combined plug device.

1 - plug; 2 - mounting brus; 3 - a beam on which fastening of working parts of the device; 4 - disk roller; 5 - leveler-compactor; 6 - plates forming a thin layer; 7 - pressure springs

The sharpening angle of the disks is determined by the condition that the discs do not stick to the surface of their work surface when they are immersed in the ground and during operation. To determine at what values of this condition g angle is best satisfied, we consider the process of interaction of soil particles with the ponasimon part of the disk.

Normal N and frictional forces on the soil particles are affected by the ponasimon part of the disc. They move along the direction of the force R, which is an equal effect of these forces, and on the velocity (Fig. 2).

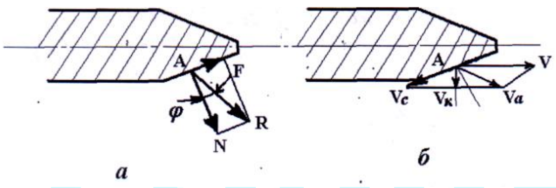



Figure 2. Scheme for determining the sharpness angle of the disk.

$$V_a = V\frac{\sin\gamma}{\cos\varphi_1}$$

where, is the velocity of the V-disk point

$$V_k = V_a\cos(\lambda+\varphi_1) = V\frac{\sin\gamma}{\cos\varphi_1}\cos(\gamma+\varphi_1)$$

And we find the velocity component perpendicular to the direction of motion.

It can be said with complete confidence that at the values of the angle g, which ensures the maximum Vk, the probability of adhesion of the soil r to the working surface of the disk is minimal.

To find the value of g that maximizes Vk, we examine the expression (2) to the extremum on g.

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$$\frac{dV_k}{d\gamma} = V\cos\varphi_1[\cos\gamma\cos(\gamma+\varphi_1) - \sin\gamma\sin(\gamma+\varphi_1)] = 0$$

Or

$$\cos[\gamma(\gamma+\varphi_1)] = 0$$

From here we get the following.

$$\gamma = \frac{\pi}{4} - \frac{\varphi_1}{2}$$

where g is the sharpening angle of the disk, grad.

Substituting certain values of φ1 (25–35 °) into expression (4), we determine that the sharpening angle of the disc is in the range of 55–65 °. From these we assume an average value, i.e., 2g = 60 °. This is because the equally acting part of the forces N and F (Fig. 2) is oriented close to the vertical, ensuring good compaction of the soil.

We find the diameter of the disc of the plug device in the condition that it passes without pushing the blocks that it encounters in its path. To do this, we consider the forces acting on the particle that interacts with the disk.

$$F_1\cos\varepsilon + F_2 \geq N_1\sin\varepsilon$$

where ε is the angle of inclination relative to the test horizon, which is transferred to the point where the disk touches the block;

$$F1 = N1tg\varphi1 \text{ and } F2 = N2tg\varphi2$$

where φ1 and φ2 are the external and internal friction angles of the soil (slab).

From the condition of equilibrium of the forces acting on the block

$$N2 = N1\cos\varepsilon + F1\sin\varepsilon = N1\cos\varepsilon + N1tg\varphi1 \cdot \sin\varepsilon. \quad (6)$$

Substituting the values of F1 and F2 into expression (6), we obtain the following.

$$N1tg\varphi1\cos\varepsilon + N2tg\varphi2 \geq N1\sin\varepsilon \quad (7)$$

Instead of N2 we put its value in the expression (7)

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N1tgφ1 cos ε + N1 (sosε + tgφ1 sinε) tg φ2≥ N1 sinε (8)

We abbreviate this expression to N1

tgφ1 cosε + tgφ2 cos ε + tgφ1 tgφ2 sin ε ≥ sinε (9)

from here

tgφ1 + tgφ2 ≥ tgε - tgφ1tgφ2tg ε (10)

or

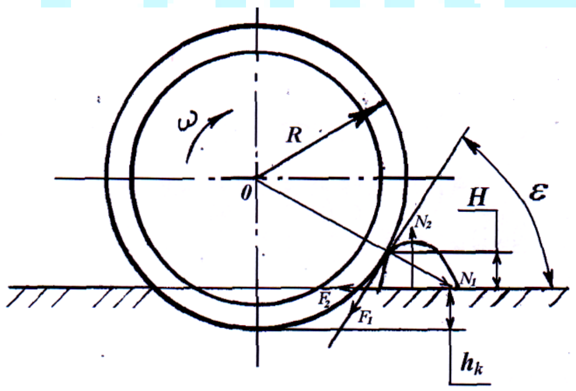
$$\frac{tg\varphi_1 + tg\varphi_2}{1 - tg\varphi_1 tg\varphi_2} \geq tg\varepsilon \qquad (11)$$

$$tg(\varphi_1 + \varphi_2) \geq tg\varepsilon \qquad (12)$$

or

ε≤ (φ1 + φ2) (13)

Figure 3. The disk diameter determination scheme.




From the diagram shown in Figure 3

R - R cos ε = N + hk (14)

We solve this considering (14)

The analysis of this expression shows that the diameter of the disk depends on the size of the lumps on the soil surface, the depth of immersion in the soil, the physical and mechanical properties of the soil, ie the values of friction angles φ1 and φ2.

The values of N and the friction angles φ1 and φ2 in (16) vary considerably depending on the condition and type of soil. Therefore, the largest values of N and hK and the smallest values of φ1 and φ2 are obtained in the calculation to ensure the wide range of performance of the disk.

To determine the diameter of the disk, we put the following values in expression (16) N = 5 cm, hK = 5 cm, φ1=250, φ2=350 disk diameter is not less than 40 cm.

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