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CALCULATION OF BODY RACKS AND SKIMMERS

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Abstract

The aim, device, designs, and individual technical aspects of machine and tractor units, universal energy methods for soil cultivation, sowing, and planting of plants, technological systems and complexes of animal husbandry are all specified. The gadget and designs of machines are provided in the logical link of the executive's functions, transmission mechanisms, and agricultural production technical processes. The essential provisions, methods and technical means of precision farming, as well as the principles and means of agricultural process automation, are discussed. PM.02 "Operation of agricultural equipment" of the training program for mid-level specialists in accordance with the Federal State Educational Standard of the SPO speciality "Mechanization of Agriculture," for the development of the type of professional activity "Technician-Mechanic."

Introduction

It is vital to cultivate the ground in order to increase the production of any crop. The emphasis is on soil fertility restoration. Depending on the local requirements, traditional and resource-saving tillage methods are applied.

During plow operation, the legs of the bodies are loaded with bending and torque moments. The value of the bending moment in the vertical plane is M_y = ~ 20 000 k*Gsм,* during the first boring, the bending moment can reach the value of $M_{y\,max}$ = 40 000 k*Gsм*.

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If installed incorrectly, the plow can go in the furrow with a bias of up to 8° and at the same time the field boards of the bodies will perceive a lot of pressure from the furrow posts. As a result, bending moments acting in vertical transverse planes can grow up to M_y = ~ 15 000 kGsм.

The torques acting on the pillars of the hulls during plowing under normal conditions are equal to Mп p = ~ 5000 kGsм, but when they meet with an obstacle or when plowing dry soil, they can increase up to $M_{n\,p\,max}$ = - 20 000 ÷ 30 000 kGsм.

Racks of plow bodies are usually cast and Bessemer steel grade *L15*. The shape and dimensions of the upper section of the rack are shown in Fig. 1. The main axes 1 and 2 of this section are rotated relative to x and y by an angle α=13° Geometric characteristics of the column section: F = 34 sм², I_1 = 375 sм², I^2 = 504 sм⁴, Wp = 375 sм².

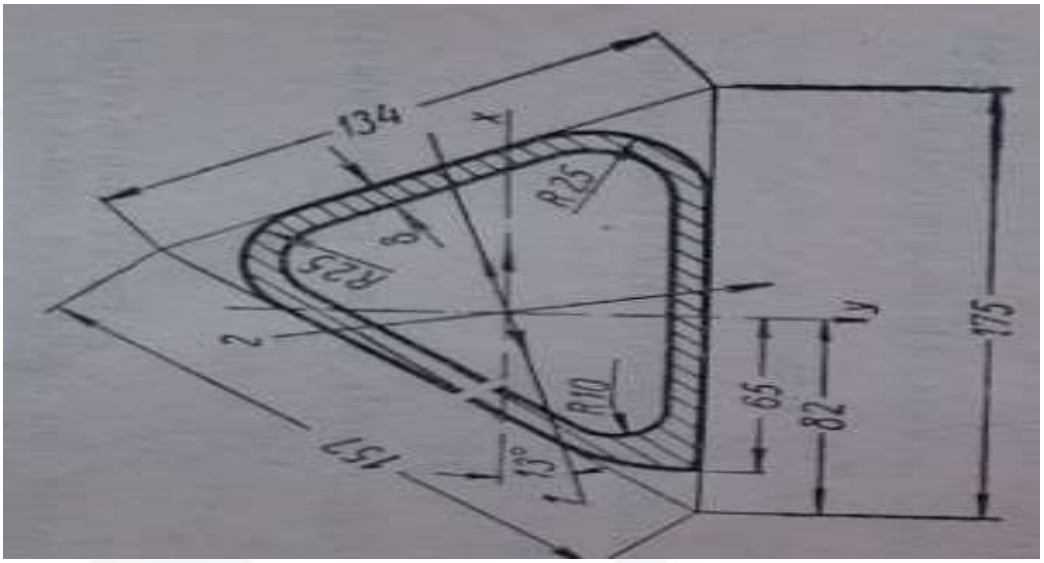

Fig. 1 Cross-section of the cast housing post

The tine of the plow body works mainly oblique bending and torsion. The greatest tensile stresses on the front edge of the tine can reach

$$\sigma^2 = \frac{M_{y\,max} * \cos 13^0}{J_2} * u + \frac{M_{y\,max} * \cos 13^0}{J_2} = \frac{40000 * 0.975 * 8.2}{504} +$$

$$+ \frac{15\,000 * 0.2221 * 8.2}{504} = 690\ кГсм2.$$

where is the distance of the front edge of the rack from the axis 2

Normal stresses from bending of the rack along the transverse plane will be

$$\sigma_2 = \frac{Мумах * sin13 * U}{J2} + \frac{Мумах * cos13 * U}{J2} = \frac{40000 * 0.2221 * 4.2}{375} +$$

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$$+\frac{15\,000*0,975*4.2}{375} = 65 \text{ kGsм2}.$$

where is the distance of the left side edge of the rack from axis 1

The largest shear stress from smoking of the rack of the case are equal

$$\tau_{\text{max}} = \frac{\text{M}_{\text{крmax}}}{\text{W}_n} = \frac{30\,000}{210} = 143\ kG/sм^2.$$

Then the reduced stresses can reach the value

$\sigma_{\text{пр}} = \sqrt{\sigma^2 + 3\tau^2} = \sqrt{690^2 + 3 \times 143^2} = 860$ During field tests of the mounted plow, the stresses on the front face of the rack varied from $\sigma_2 = 350\ kG/sм^2$

$\sigma_2 = 770$ kG/sм², astresses on the left side face from $\sigma_2 = 580$ kG/sм² *до* $\sigma^2 = -1400\ kG/sм^2$, *shear stress from torsion of the body pillar, during plowing, varied from* $\tau = 110\ kG/sм^2$, *to* $\tau = 700\ kG/sм^2$, *moreover, the torque was directed counterclockwise.*

The skimmer stand is made of strip steel grade MCT 5 with a section of 30x70 mm. During plowing, the skimmers are subjected to moments bending in the longitudinal vertical plane *My 8500 kG/sм²* bending in the transverse vertical plane M_y" *2500kG/sм²* torsional M_y" *3000kG/sм²* Moments resistance cross-sections of the skimmer strut are equal to 12.22 and En=15,9sм²

The calculated normal stresses from bending on the front face of the skimmer strut are equal to

$$\sigma_1 = \frac{\text{My}''}{\text{W1}} = \frac{8500}{24,5} = 350\ kG/sм^2$$

The stresses on the side face of the skimmer strut are

$$\sigma_2 = \frac{\text{My}''}{\text{W1}} = \frac{2500}{10,5} = 240\ kG/sм^2$$

The highest shear stresses from torsion of the rack housing are equal to

$$\tau_1 = \frac{\text{My}''}{\text{W1}} = \frac{3000}{15,9} = 190\ kG/sм^2$$

The reduced stresses on the front face of the rack will be $\sigma np = \sqrt{\sigma^2 + 3\tau^2} = \sqrt{350^2 + 3 \times 150^2} = 140\ kG/sм^2$

Experimental stresses in the upper section of the front face of the skimmer strut during laboratory tests were σ_1=210÷240 *kG/sм²*.

During operation, the stresses in the skimmer struts changed from σ_1=330*kG/sм²* before σ'_1=740*kG/sм²*. The tangential stress from twisting of the skimmer body struts varied from

$\tau_2 = 120\ kG/sм^2$ до $\tau_2 = 360\ kG/sм^2$, the torque acting in a clockwise direction.

Conclusion

It is vital to use and construct the housing supports correctly when loaded with bending and turning moments during plowing. Curved bending and twisting are the most important aspects of using the pole body of a plug correctly. The optimal housing design not only extends the life of the plug, but also increases its effectiveness, due to the high maximum stresses on the anterior area of the tooth.

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