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Calculation of the Resistance Elements of the Hydraulic Components Rotary System of Telescopic Mast MU 100

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Abstract

The paper presents the calculation of stresses and movements in the hydraulic system of rotation and mechanic telescopic system of the mast MU100, drilling instalation F100. Given the practical importance of the two operations, measuring the resistance of the two systems should be performed with great precision.

Key-words: *Hidraulic components,rotary sistem, telescopic mast*

Overview

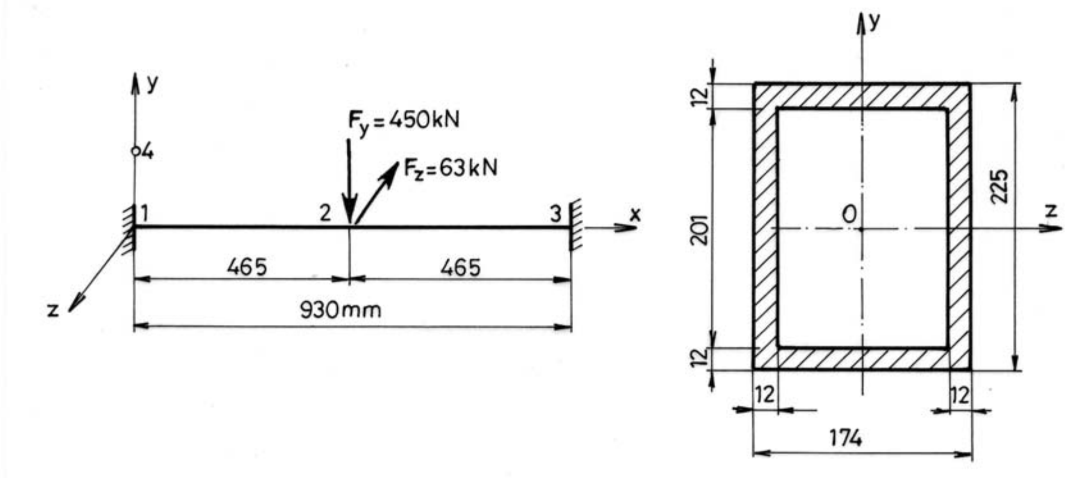
To transport the drilling F100, all components (section fixed with stabilizers; section below; crown block, monkey board, working platform; strength anchors and anchors to be fixed in the soil) are mounted on lorry chassis horizontally . For rotation from the horizontal position in an upright position using a hydraulic system, consisting of cylinder and piston, mounted on the bottom on a timber mounted on the chassis, and at the top on a timber mounted on the lower section.

Lowering Beam on Lorry Chassis

Beam was divided into two finite space bar (BEAM), using three nodes as in Figure 1, a. The bar is a box 174 * 225 * 12mm (fig.1, b), the full length bar. Beam is considered embedded in the chassis spars in nodes 1 and 3. by running the program have obtained results in Table 1.

Table 1. Results for beam divided in two finite space bar

Nodes	Movement by Oy axis [mm]	Movement by Oz axis [mm]	Total Movement [mm]	Maximum stress σ_{max} [N/mm^2]
1	0	0	0	120
2	-0.21	-0.02	0.211	120
3	0	0	0	120

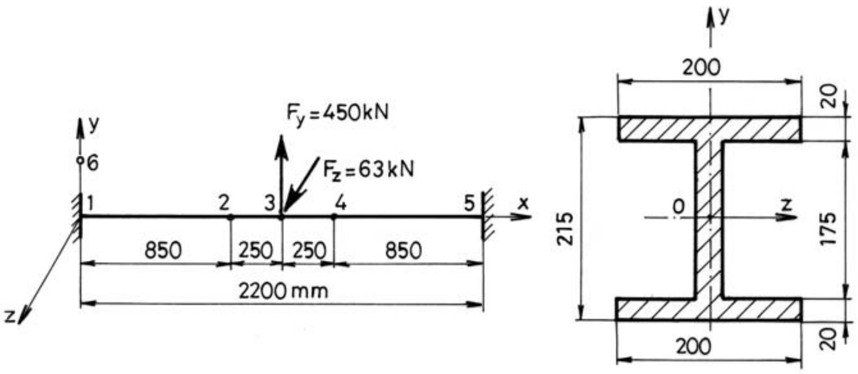


a) b)

Fig.1. Lowering beam on lorry chassis

Lowering Beam on the Lower Section of Mast

The beam was divided into four elements of finite type space bar (BEAM) as in Figure 2, a. The bar is in the form of I, with height of 215 mm, while feet were 200 * 20 mm, as in Figure 2, b.



a) **b)**

Fig.2. Lowering beam on the lower section of mast

Results obtained by running the program are given in Table 2.

Table 2. Results for beam divided in four elements of type space bar

Nodes	Mouvment by *Oy* axis [mm]	Mouvment by *Oz* axis [mm]	Total mouvment Δ [mm]	Maximum stress σ_{max} [N/mm^2]
1	0	0	0	233
2	1.37	0.54	1.473	140
3	1.56	0.62	1.679	230
4	1.37	0.54	1.473	140
5	0	0	0	233

Calculation of Forces in the Branches of Rotation Cable

Sub-assemblies to be raised simultaneously for telescoping mouvment are:
- top-section of mast with weight 23 kN;
- monkey block (including its anchors) with weight 10 kN;

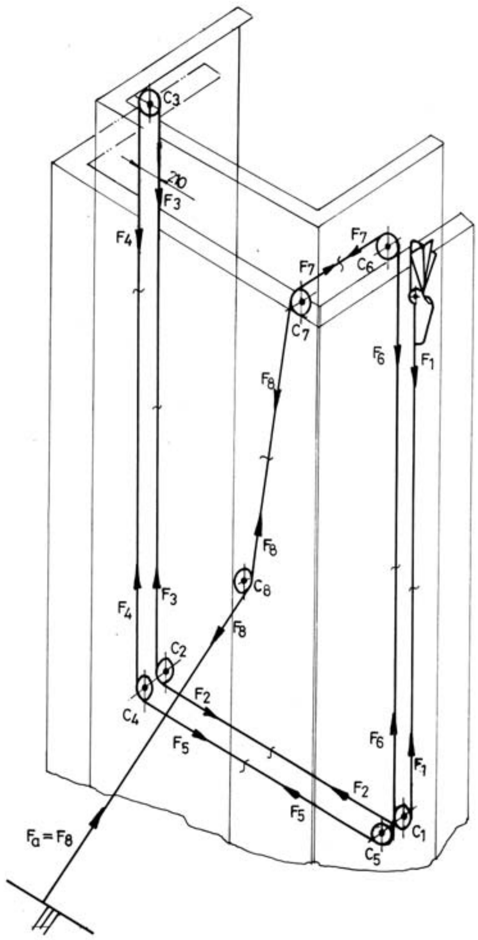


Fig.3. Forces in the branches of rotation cable

- bridge-pumping rods with weight of 3 kN;
- resistance-anchors with weight of 0.9 kN;
- operating cable (length 150 m) with weight of 3.5kN;
- crown board weighing 8kN;
- crane weighing 11kN;
- inner-cylinder weighing 9kN;
- pushing hydraulic weighing 2.5 Kn.

The values of weights are taken from work[3]. Weight to be lifted is $G \cong 75$ kN
Weights above were calculated for the drilling F100 [3].
Weight to be lifted is calculated by the relationship $G_c = \psi \cdot G = 1.2 \cdot 75 = 90$ kN, where ψ is the dynamic factor, according to STAS 1909-89 [4]. For rotation are used 8 rolls of diameters equal to 210 mm, placed as in Figure 3.Rolls C_1 , C_2 , C_4 and C_5 are attached to upper section, making the furniture (which is mouving up). Rolls C_3, , C_6 , C_7 and C_8 and the dead

end are fixed to the lower section of mast (the fixed part). The force F_1 is calculated by the formula: $F_1 = \dfrac{Q}{1+\beta+\beta^2+\beta^3+\beta^5}$, where β is the coefficient that takes account of the cable stiffness and friction of rolling bearings. $\beta = 1.04$ according STAS 1909-89 [4]

Forces have the following values:

$F_1 = 20.35$ kN ; $F_2 = \beta \cdot F_1 = 21.16$ kN; $F_3 = \beta \cdot F_2 = 22.01$ kN; $F_4 = \beta \cdot F_3 = 22.89$ kN;

$F_5 = \beta \cdot F_4 = 23.81$ kN; $F_6 = \beta \cdot F_5 = 24.76$ kN; $F_7 = \beta \cdot F_6 = 25.75$ kN; $F_8 = \beta \cdot F_7 = 26.8$ kN.

For telescopic mouvment will use a cable that has the force of breaking

$$F_r > c \cdot F_a = 3 \cdot 26.8 = 80.4 \text{ kN}$$

Conclusions

For the beams studied, the condition of deformation: $\dfrac{l}{\Delta_{max}} = \dfrac{2200}{1.679} = 1310 > 400$ satisfied.

Provided resistance for the two beams $\sigma_{max} = 233$ N/mm^2 $< \sigma_a = 275$ N/mm^2 satisfied. Used steel OLC45 with yield stress $\sigma_c = 410$ N/mm^2 and allowable stress $\sigma_a = 275$ N/mm^2, according to STAS 1909-89.[4]. So, beams are well dimensionated. For used cable at telescopic system, allegate cable with $\phi 14$mm, with breaking force $F_r = 112.79$ kN, according to STAS 1689-89[5], with the coefficient of safety $c = \dfrac{112.79}{26.8} = 4.2 > c_a = 3$, so the cable is well chosen.

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5. * * * STAS 1689 / 89.

Calculul de rezistență al sistemului hidraulic de telescopare al mastului MU 100

Rezumat

În lucrare se prezintă calculul de rezistență al sistemului de telescopare al mastului instalației de foraj $F100$. *Cele două grinzi de rezistență sunt tratate ca o succesiune de bare dublu încastrate, una cu secțiune tip casetă, alta cu secțiune profil I. Calculele au scos în evidență faptul că proiectarea a fost corectă, obținându-se un coeficient de siguranță egal cu 4.2, față de valoarea 3 a coeficientului de siguranță admisibil.*