DETERMINATION OF LOADS TRANSMITTED TO THE TOWER OF THE EXTRACTING INSTALLATION „AUXILIARY WELL JIEŢ“ E.M. LONEA IN THE CASE OF THE APPLICATION OF THE SAFETY BRAKE

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Abstract: In the paper there are presented certain aspects concerning the determination of loads transmitted through the bearings of the extracting pulleys of the structure of the towers of the extracting installations in the case of the application of the safety brake The exemplification of the determination of the loads transmitted to the metallic tower in the case of the application of the emergency brake has been done by taking into study the extracting installation „Auxiliary well Jieţ", from E.M. Lonea The extracting installation is unbalanced. The wrapping organ of the installation machine is a double wheel with the wrapping of the extracting cable in one layer. The extracting vessels are untipping cages with two levels, with two trolleys per level. The drive of the installation's machine is asynchronous, the machine's reducer having two drives

Keywords: analytical calculus, force

1. INTRODUCTION

The normal evolution of the schedule of the movement of the extracting vessels or the stopping of the machine in a certain position of the vessels (maneuver braking) and the automated stopping of the machine (safety brake), independent of the will of the operator in one of the cases considered perturbations or distress, is insured by a braking device supplied with every extracting machine. Cases considered perturbations or distress are: lack of tension, a decrease in fluid pressure required for

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acting the brake, over-height of the extracting vessels, passing the max. speed limit overweight etc.

In the paper there are presented certain aspects concerning the determination of loads transmitted through the bearings of the extracting pulleys to the structure of the metallic towers of the extracting installations in the case when the emergency brake is applied due to an overcome of the max speed allowed.

In order to study the loads from the extracting cables transmitted to the structure of the metallic towers of the extracting installations through the extracting pulleys in the case when the emergency brake is applied it has been taken into study the tower of the extracting installation ,, Auxiliary well Jieţ '' E. M. Lonea.

The general and exploitation data of the installation taken into study are forward presented .

2. THE EXTRACTING INSTALLATION TAKEN INTO STUDY

The extracting installation which works on auxiliary well Jieţ, from Lonea mining plant, which is devoted [3] for the underground supply with materials and tools as well as for transporting personal among levels 400 and 715 (the surface level being 715).

Fig. 1.Extracting installation Auxiliary well Jieţ "

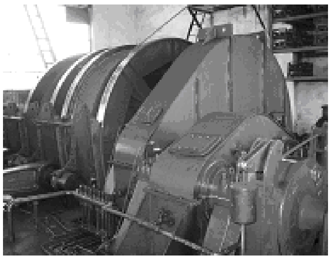

Fig. 2.Extracting machine type BAMERT $3\times0{,}9$

Fig. 3. Installation tower ,, Auxiliary well Jieţ "

The extracting installation that supplies the well (fig.1) is unbalanced and has a hoistingmachine type BAMERT 3000×900 equipped with two asynchronous motors type MAF, (fig.2) of 125 kW power and a nominal rpm of 585 rpm. The gear reducer of the machine is of type TD-170 having the gear ratio of 11,5. The extracting ropes with diameters of Φ 27,5 mm and a mass (on a linear meter) of 3,2 kg/m on the left branch (from the extracting machine to the well) and on the right branch are wrapped around the two extracting pulleys the superior and the inferior one, of Φ 2000 mm with a mass (the pulley, the axle of the pulley and the bearing of the axle) of 2050 kg (fig.3), laying on the tower at heights of 34.4 m respectively 31.4 m (pulley axle).

The extracting vessels are untipping cages with one level, with two trolleys per level having a mass (own mass plus D.L.C.) of 3355 kg. The mass of a trolley is of 650 kg, and the effective load is 1600 kg/trolley.



Fig. 4. Pulley platform **Fig. 5**. Leading component **Fig. 6**. Abutment

The concrete made tower (fig.3) with a height until the pulley axle of 34.4 m.

The structure of the tower is composed of the extracting pulley platform (fig.4) sustained by the leading component(fig 5) and the abutment (fig 6) The extracting machine lies on the ground (at a height of 2,8 m to the 0 level of the well (well collar), sideways from the tower (well tower), at a distance (of the wheel axle), towards the vertical portion of the extracting ropes which enter the well of 27,32 m.

The length of the rope chord (the distance between the tangent points of the rope to the deviating pulley from the tower and the wheel of the extracting machine, in the central position of the chord (perpendicular on the wheel axle)), is for the left branch Lcs = 37,62 m, and Lcd = 44,89 m for the right branch.

The slope angles of the ropes chords are βs = 530 47’ 04” for the left branch and βd = 490 39’ 36”, for the right branch, and the deviating angles (which are formed in the limit positions of the rope chord towards the interior side(interior angle) or exterior (exterior angle) of the wheel, over the central position of the chord) are: αe st =19’29’’ and αi st=0 for the left branch and αedr = 31’53’’ and αi dr = 0 for the right branch.

3. DETERMINATION OF LOADS

For the determination of the loads(efforts) which act upon the installation taken into consideration in case of applying safety brakes , it has been taken into study the case when one of the vessels loaded with materials is descending on one of the branches.

On the calculation of loads it has been considered the fact that their variation is determined not only by the kinematics of the installation (kinematical parameters) but also by certain geometrical elements which define the position of the extracting machine towards the well geometrical elements regarding only the installations where the extracting machine lies on the ground.([1],[3],[4]).

In fig 7 and fig 8 is presented the variation diagram for the deviation interior and exterior angles on the two extracting branches and for the two wheels of the wrapping organ of the extracting cable in the two considered cases.

For this purpose it has been taken into analysis the case when the full vessel(filled to max load) is descending on the right branch (case 1, the left vessel is climbing and the right one is descending) and the case when the full vessel is descending on the left branch (case 2, left vessel is descending and the right one is climbing).

The diagrams for the space, speed, and acceleration for the two cases taken into analysis are presented into fig 9 case 1 and in fig 10 case 2. The variations of acceleration and space have been used for the calculation of the loads applied to the tower.

The determination of the loads acting upon the tower through the deviating pulleys has been done using the d'Alembert principle (the kinetics-static method [2]) taking into consideration the static forces (the weight of the extracting cable, the cage the trolley the pulley and the load), the friction forces (multiple friction and aero-dynamic resistances which for installations with cages is approximated with a coefficient of $k^{'}$=0,2 from the useful load [1]) and the dynamic forces (which intervene. only in the acceleration and deceleration periods, (fig. 9 and fig.10))

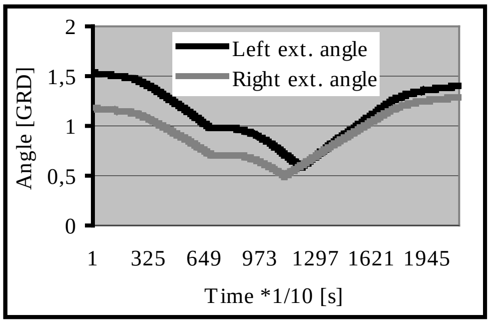

Fig. 7. Deviating angles for Case 1

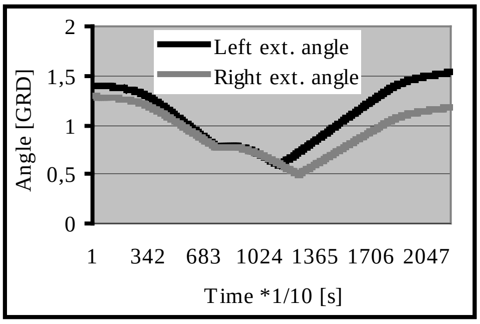

Fig. 8. Deviating angles for Case 2

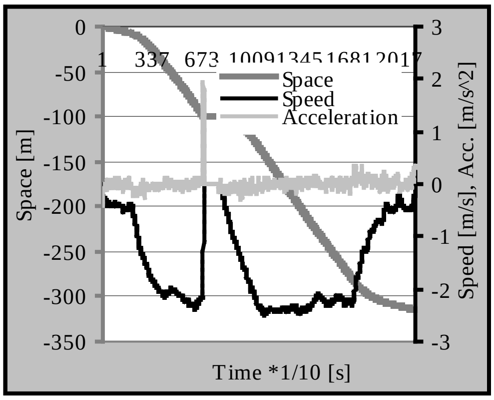

Fig 9 . Speed acceleration and space for Case 1

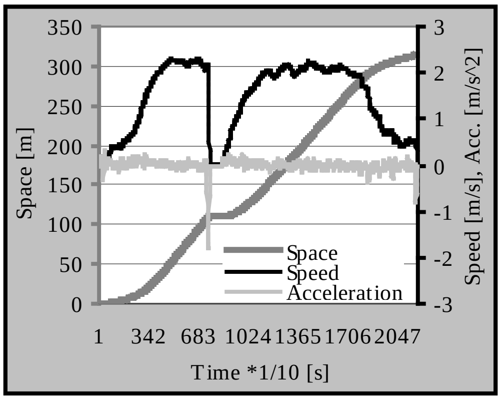

Fig. 10. Speed acceleration and space for Case 2

The variation of the components of the forces from the bearings of the extracting pulleys for the two cases taken into consideration in the case of the application of the security brake on the surpassing of the max admitted speed is presented in fig 11,case 1 and fig 12, case 2.

The variation of the total resultants (reactions) the forces from the extracting pulleys for the two cases taken into consideration in the case of the appliance of the safety brake on the surpassing of the max speed is presented in fig 13 case 1and fig 14, case 2, for both pulleys.

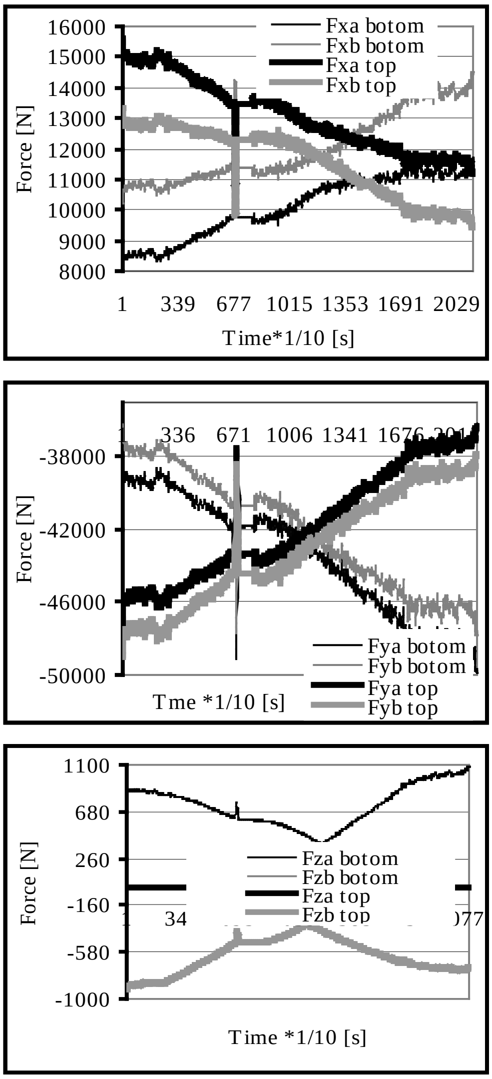

Fig. 11. Forces on the bearings for Case 1

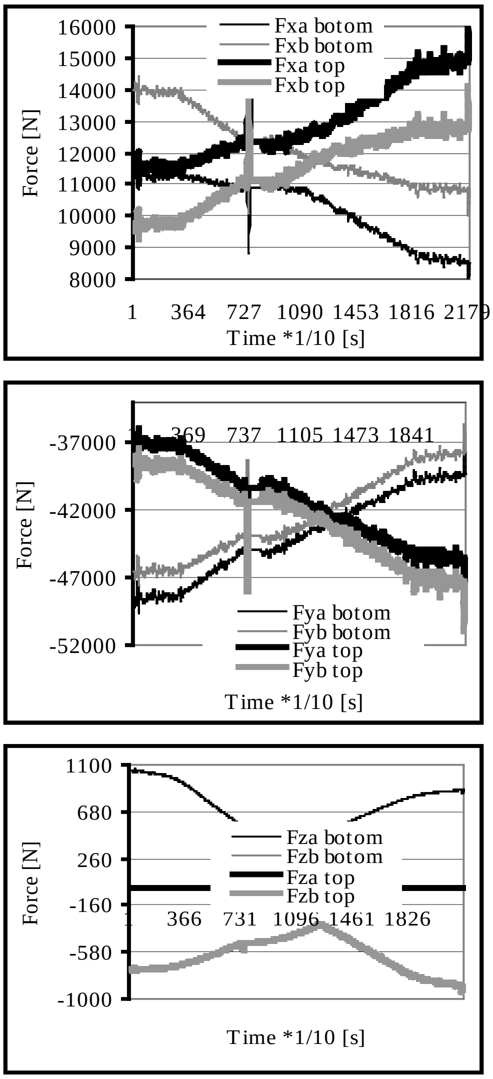

Fig. 12. Forces on the bearings for Case 2

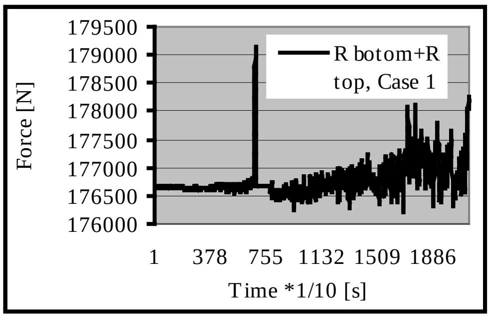

Fig. 13. Total loads when the left cage descends and the right one climbs Case 1

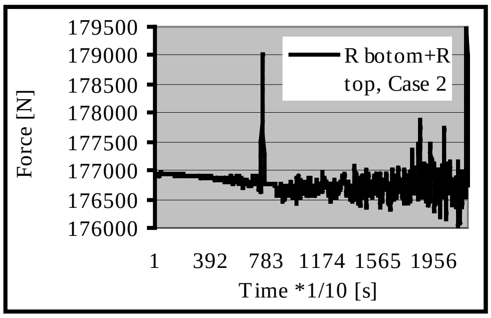

Fig. 14. Total loads when the left cage climbs and the right one descends Case 2

4. CONCLUSIONS

The calculation the structure of the mining extracting towers is done taking into consideration all the unfavorable combinations practically possible of the different loads called groups of loads.

The loads transmitted to the tower through the bearings of the extracting pulleys from the tower due to the efforts from the extracting cables have been considered for an extracting cycle when the empty cages are climbing and descending on one of the two extracting branches.

The variation of loads is due both for the cinematic parameters as well as for the geometric parameters of the extracting installation.

As noticed from the variation of the total loads which act upon the tower during an extracting cycle in the case of the appliance of the safety brake the maximum values are in case 1 towards the end of the cycle and in case 2 at the beginning of the cycle (fig 13 and fig 14), and not at it's end like in case 1..

The maximum values of the loads determined are further used to determine the values of mechanical stress and strain from the elements of the structure of the metallic tower of the installation in order to verify its resistance.

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