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AN EXPERTS'S ACCOUNT OF STRENGTH OF THE SELECTED CONSTRUCTIONAL ELEMENTS OF CONTAINER MANIPULATOR FOR THE DRILLING RIG JSVA - 5K

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The contribution concerns the experimental tension analysis of some constructional elements of the container manipulator for the drilling rig JSVA - 5K and the proposition of measures for improving strength in the critical sections.

1) Introduction

A Container manipulator is a basic component of the technical solution of manipulation and transport of the drilling rig designed by the Geological Research - State company, Špišská Nová Ves within the framework of the research " Complex Containerization of the JSVA - 5K".

The Department of the Technical Mechanics and Elasticity at Technical University Košice was asked for an assistance to verify a functional reliability of a prototype of the manipulator in operational conditions and on the basis of experimental analysis of the tension in the selected contructional components to design in the justified cases new constructional implementations, respectively to apply new materials. The results of the analytical solution were also taken into account when selecting an institution for an experimental analysis [1].

2) A description of a beam construction of the container manipulator

The container manipulator is installed on a chassis of Tatra 815 Agro Z- 22, (see Fig. 1).The constructional design of the manipulator enables also its end (a bed for its cylindrical pin) when loading or unloading of the container an independent movements in radial or transversal directions. The diagram of the mechanism in three different positions with an extended arm is depicted in Fig. 2.

Shifting movements of the container in horizontal or sloping positions are provided by a telescopic arm 1s with a 45 kN hydromotor (LH1) (for loading) and with 100 kN disengaging strength (for unloading). Revolving of the disengaging arm is provided by two linear hydromotors (LH2) synchronically working and by means of the beams 2 and 3.

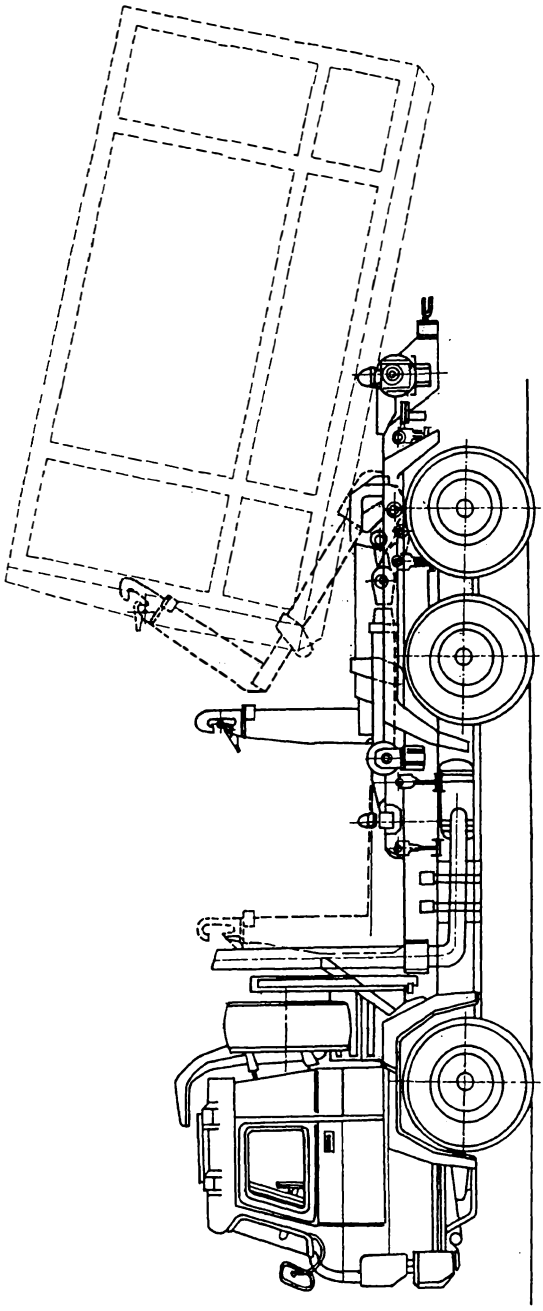

Fig.1

The process of tilting of the container with higher mass than 3 tons according to the technical conditions is possible only in case when both telescopic parts of the arm 1 are retracted.

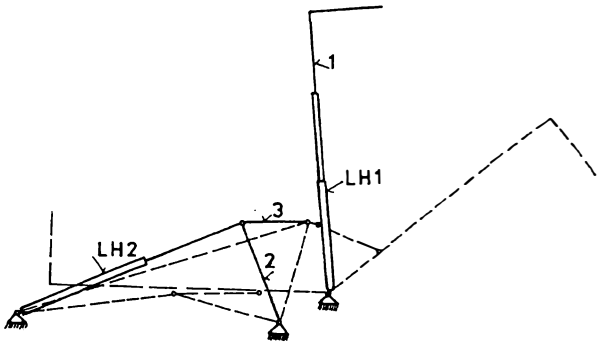

Fig.2

3) Experimental analysis

An experimental analysis was carried out by means of resistant tensometry. Strain gages were applied on the components on the following sections:

A,B,G - cranked part of the arm

C - medium part of the arm

D - external part of the telescopic arm

V - a pair of the arms 3

F - the arm 2

The positions of the detectors on the above mentioned places are evident from Fig. 3.

Measurement was performed in two phases. In the first phase tension was determined by means of static load for the selected phases of the operational positions when manipulating with an empty or a loaded container.

In the second phase the positions with non substantial changes in tension were excluded from the set of the data. On the remaining places time dependences of relative deformations for complete operational cycles of loading and unloading of the 10.5 ton container and the manipulator with an empty container were recorded.

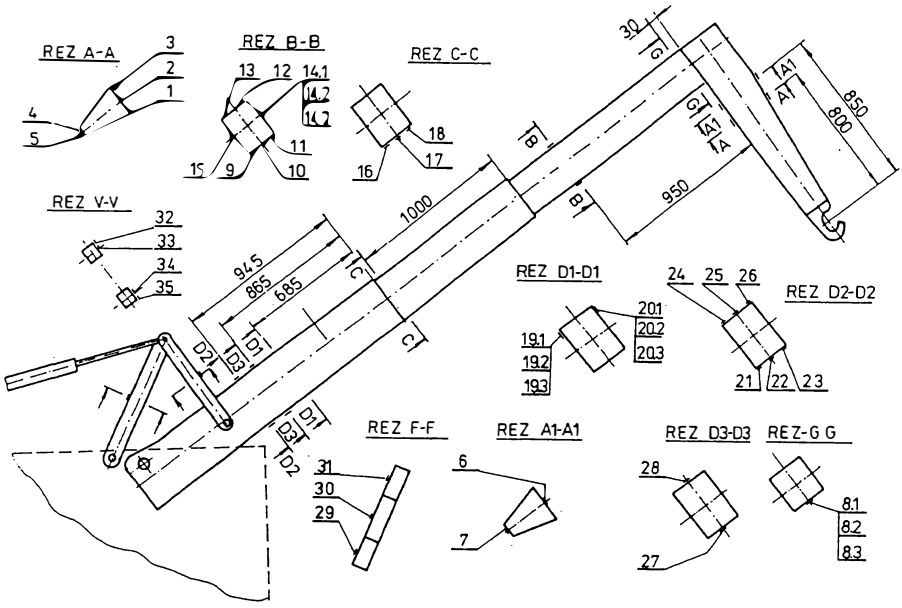

Fig.3

The dynamic measurement showed that when simulating operational regimen an influence of the dynamic factors did not exceed the values of static components more than by 20 %.

Conclusion

When commenting on the acquired results in the framework of the contribution we would like to concentrate only on critical sections. From the experimentally determined values it is evident that with the exception of the section G (the detectors 8.1, 8.2, 8.3)the values of the tension are considerably lower than the boundary of steel 11523 slip is.In the section G the measured values of tension are higher than boundary slip of the material R_e = 390 MPa is.

The customer has been offered several solutions of the issue:

- when applying the material 11523 it is necessary to replace 8mm by 10 mm bands -for existing values of the section characteristics it is necessary to apply material with a boundary slip range in the interval from 460 to 500 MPa
- it is necessary to adopt constructionally the junction by adding a fixing rib for improving transfer of flow of strenth.

From the analysis it is evident that dynamic coefficient does not exceed the value 1.2 in the operational conditions.Further fact that is worth noticing concerns the possibility of decreasing mass of components that were experimentally examined by 20 up to 30 %. Coincidence of the results acquired by measurement and by calculation is favourable with an exception of the dynamic coefficient,which has a lower value than it was expected.

References

[1] Kontajnerizácia vo vrtnom procese - komplexná kontajnerizácia JSVA-5K. Záverečná správa rezortnej výskumno-vývojovej úlohy T-107. Turčianske Teplice, 1984.

[2] Trebuňa,F. a kol.: Experimentálne určenie napätosti vo vybraných miestach kontajnerového manipulátora a koncepčný návrh konštrukcie výložníka z vysokopevných ocelí. Košice, 1990

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