MODELLING AND CHECKING THE CABLE TENSION BALANCE DEVICES

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Abstract: The cable tension balance devices make the connection between the extraction vessel (the skip) and the cable connecting devices, the DLCs, and they have the role to equalize the tensions within the multi-cable extracting installation cables. The devices that are used for the mining working in the Jiu Valley are made up of two cables for the 12 tons skips and of four cables for the 8 and 14 tons extracting capacity skips.

Keywords: cables, device, balance, tension

1. INTRODUCTION

When modelling, drawing up the 3D execution papers for the cable tension balance devices, the following techno-economical aspects were taken into account:

- improving the constructive solutions technologically speaking (the prop plate welded, the splint pin);
- standardizing, as possible, the constructive solutions for the cable tension balance devices that equip the multicable extracting installation cables in the Jiu Valley;
- using the constructive solutions that have been put into practice and checked with similar devices;
- keeping the existing safety coefficient and, in some cases, having it increased (at the 14t skip the pins were smaller than those from the 8t skip);
- decreasing the price by reducing their making up manual labour (reducing the connection piece, which has the lowest degree of using the material and establishing the correct usage of the alloy steel pieces).

The constructive-functional characteristics of the DEC-12 and DEC-14 cable tension balance devices are shown in table 1.

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Table 1. **The constructive-functional characteristics of the DEC-12 and DEC-14 cable tension balance devices**

Nr.	Characteristic name		M.U.	Characteristic value	
				DEC-12	DEC-14
1	Nominal static charge		tons/kN	12/120	14/140
2	Maximum static charge		tons/kN	60/600	52/520
3	The type of the device		-	Mechanic with working beam	
4	The number of working beam		piece	1	3
5	The type of tensions equalizing mechanism		-	Screw-screw nut	
6	The operation of tensions equalizing mechanism		-	Mechanism with a catch	
7	The motion of tensions adjusting		mm	375	265
8	The angle of lever tipping		degree	±45	±30
9	The maximum vertical difference between two DLCs		mm	500	150
10	The type of cable binding device		-	DLC-30	DLC-1 DLC-13
11	The number of cables		piece	2	4
12	The distance between cables		mm	900	300
13	The diameter of the DLC connection pin		mm	110	70
14	The diameter of the skip connection pin		mm	110	80
15	The number of the skip connection pins		piece	2	2
16	Clearance gauge dimensions	Length (height)	mm	3286	2528
		Width	mm	1284	1145
		Thickness	mm	869	732
17	The mass		kg	1936	1235

2. THE CONSTRUCTION AND FUNCTION OF CABLE TENSION BALANCE DEVICES

The main component sides of the DEC-12 cable tension balance device are presented in fig.1

The DEC-12 cable tension balance device realizes the connection between the skip and the two cable connection devices, assuring the balance between the tensions in the two cables.

The device is made up of the catching cover plate of skip *1*, fixed by this one by means of two pins *2*, with the diameter of 110 mm, fixed on the cover plate with the help of the fixing plates and the M12 screws. Label *20*, of device identification, is attached to the cover plate.

On the upper side, the cover plate is connected to the main lever *4*, which plays the role of working beam, by means of the main pin with the diameter of 135 mm *3*.

The connection is assured by means of two forks *6*, and of two superior cover plates on each branch. The connection between the forks and the working beam is made through the inferior secondary pins *5*, and between the forks and the superior

cover plates through the superior secondary pins *8*, with the diameter of 110 mm.

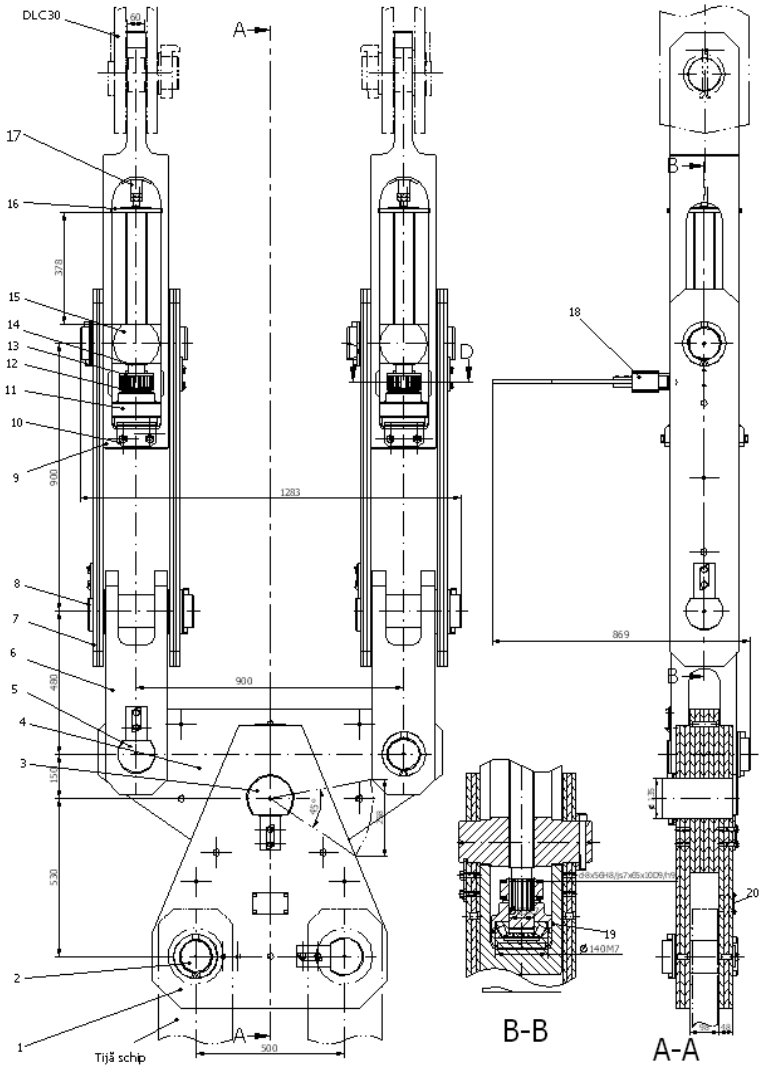

Fig. 1. The DEC12 cable tension balance device

On the superior side of the cover plates, the screw nut with clefts is mounted *15*, which makes the connection with the mobile connection piece *9*, whose superior side is fixed by the cable connection devices. The mobile connection piece is conceived in such a way as to assure a motion of tensions adjustment of 375 mm.

The structure of resistance that takes over the tensions from the cable as well as the mechanism that assures the vertical shifting is assured by the plinth plate *10*, fixed by the mobile piece by means of screws, the rod plinth *11*, the oscillatory axial

bearing *8*, the screw cutting rod *14*, which is screwed in the axels screw nut, the guidance plate *16*, and the fixing slide plate *17*, the last two pieces being in connection to the mobile piece.

The operation of the crew-screw nut mechanism is realized throughout a device with a click *13* (fig. 2), fixed through flutes on the screwed rod, operated by means of a handle *18*.

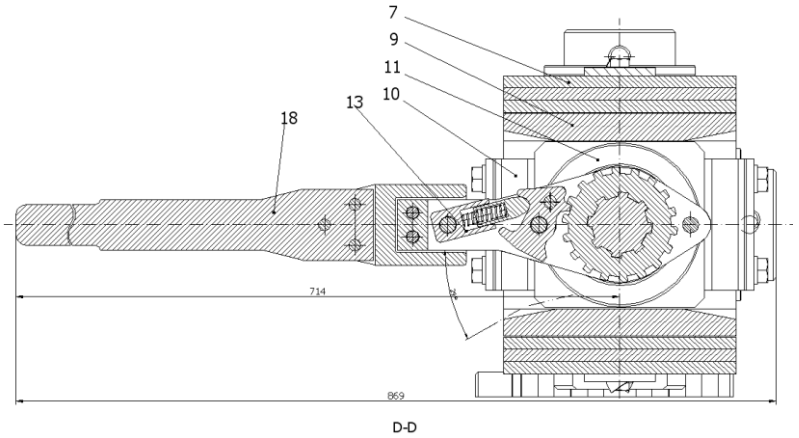

Fig. 2. Device with a catch

The main parts of the DEC-14 cable tension balance device are presented in figure 3.

The DEC-14 cable tension balance device makes the connection between the skip and those four cable connection devices, assuring the balance of the tensions in those four cables.

The device is made up of the same elements as DEC-12, except the fact that there is a difference of the elements dimensions and of the connection pins from the device joint given in table 1.

In order to assure the branching for those four cables, two intermediate cover plates *22* are used, two secondary levers *24*, playing the role of working beams, fixed through the inferior and superior secondary pins *21* and *23* with diameters of 80mm.

3. CHECKING THE CABLE TENSION BALANCE DEVICES

Because of the high safety coefficient that has to be applied to these devices, it is necessary an exact determination of the tensions in those elements, to make a better dimensioning.

Modelling the elements of the device has been made with the help of the Solid Edge software, and the analyses with finite elements have been made with the COSMOS Design STAR software.

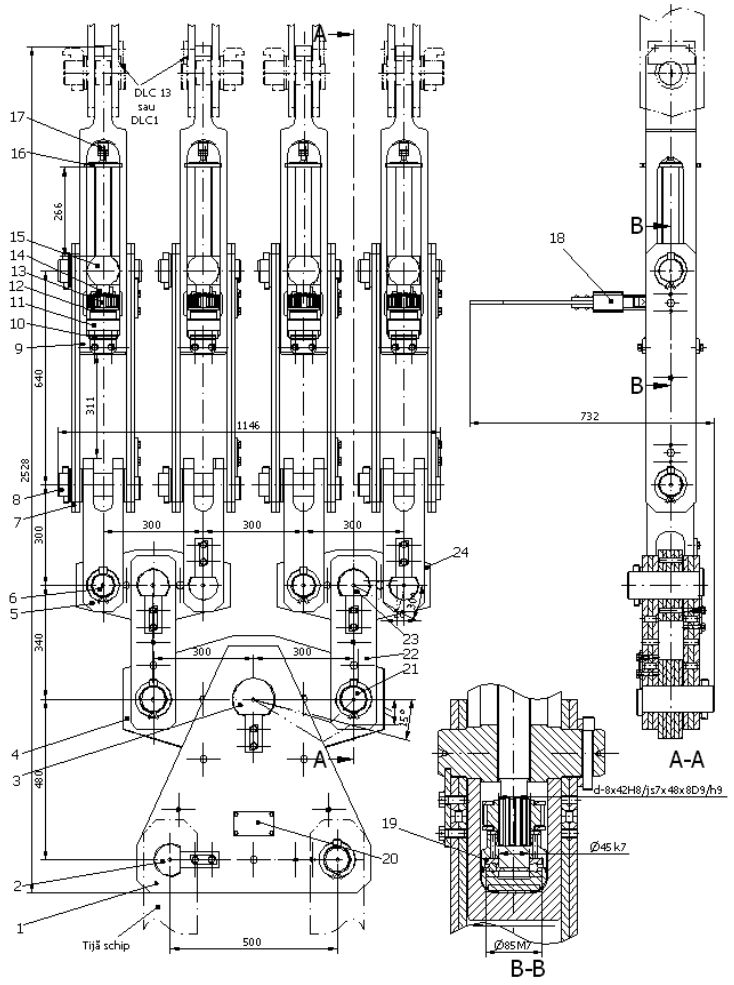

Fig. 3. DEC14 cable tension balance device

The element with the most complex shape is the connection piece between the cable connection device and the screw - screw nut mechanism, that realizes the cables stretching, respectively the limiting of the bending angle of the working beam when balancing.

4. CONCLUSIONS

Due to those mentioned above, we are to achieve, throughout attempts in the laboratory, the checking of this hypothesis given by the finite element method, that the allocation of the traction tensions within interior emissions pieces is not uniformly allocated on the entire transversal section.

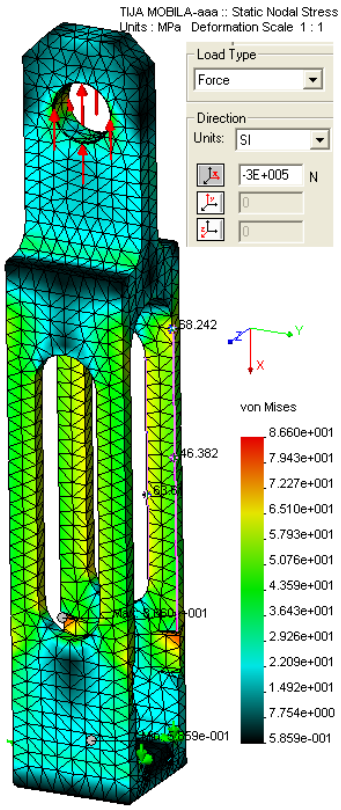

Fig. 4. The finite element analysis of the connection piece

REFERENCES

[1]. **Buzdugan, G.,** *Rezistenţa materialelor*, Editura Tehnică, Bucureşti, 1979.
[2]. **Muscă G.,** *Proiectarea asistată folosind Solid Edge*, Editura Junimea, Iaşi, 2006
[3]. **Dumitrescu I.,Cozma B.,** *The constructive analysis of the borer heads for the rotative boring*, Proceedings of the 13th International Conference, Modern Tehnologies, Quality and Innovation, ModTech 2009, Iaşi, 21-23 mai 2009, pag. 243-247, ISSN 2066-3919
[4]. **Cozma B., Dumitrescu I.,** *Stand for the rotative boring of soft rocks*, Proceedings of the 13th International Conference, Modern Tehnologies, Quality and Innovation, ModTech 2009, Iaşi, 21-23 mai 2009, pag. 211-215, ISSN 2066-3919.
[5]. **Pop I.A., Itu R.B.,** *Loads transmitted to the metallic tower of the extracting installation Puţ nou cu schip belonging to Petrila Mining Shaft in the case of the application of the safety brake*, Annals of the University of Petroşani, Mechanical Engineering, vol 15 (XXXXII), Petroşani, 2013, ISSN 1454-9166, Pages 138-145
[6]. ***, *Documentaţia de execuţie a dispozitivelor de echilibrat tensiunile din cabluri*, DEC-12 şi DEC-14.