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ADAPTATION OF THE ADVANCE SYSTEM FOR KS-3M SHEARER ADAPTED FOR 295-842 RYBNIK CONVEYER

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ABSTRACT. The paper presents technical solutions to correlate the function of KS-3M shearer with Rybnik 295/842 conveyer in order to observe Occupational Health and Safety requirements.
These machines, alongside of CMA-5H powered support make up a powered face complex used to extract coal in panel 4/seam 3/block VI in Paroseni Mine.
Key words: shearer, conveyer, correlation

ПРИСПОСОБЯВАНЕ НА СИСТЕМАТА ЗА НАПРЕДВАНЕ НА УНИВЕРСАЛНА ПОДКОПНА МАШИНА KS-3M, ЗА СЪВМЕСТНА РАБОТА С ТРАНСПОРТЬОР РИБНИК 295-842

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РЕЗЮМЕ. Статията представя техническо решение относно съвместяването на функциите на универсална подкопна машина KS-3M и транспортьор Рибник 295/842, с цел спазване на изисквания за безопасност и здраве при работа. Тези машини заедно с механизирания крепеж CMA-5H съставляват забойната техника, използвана за изземване на въглищата в панел 4, пласт 3, блок VI в мина Паросени.

1. INTRODUCTION

KS-3M shearer alongside of Rybnik 295/842 conveyer, together with CMA-5H powered support make up a powered face complex used to extract coal in panel 4/seam3/block VI in Paroseni Mine.

The shearer's and conveyer's technical characteristics, as designed by the producers were not correlated, considering that they are of different make and come from different countries. Nevertheless, the two machines show some compatibility: the shearer's cutting capacity can be supported by the scraper conveyer; dimension wise, the shearer can be mounted on the conveyer, by suitable modifications, with no essential changes that might lead to diminishing their resistance characteristics; the conveyer's robust structure resists to approximately 24 tons weight of the shearer;.

The main lack of correlation between the two lies in the fact that the conveyer is equipped with a for the guidance part, requiring a feed mechanism on the shearer with vertical driving gear (rack feed system), while the shearer is equipped with a calibrated chain feed mechanism, where the driving gear is horizontally mounted.

Moreover, at the driving and return ends of the conveyer the traction chain can not be fixed.

Therefore, the principal technical characteristics of the feed system had to be modified. The paper presents the technical solution of adapting the KS-3M shearer feed system to the 295/842 Rybnik conveyer.

2. ADAPTING SHEARER'S FEED SYSTEM TO SCRAPER CONVEYER RYBNIK 295/842

Adaptation of the shearer feed system to the scraper conveyer, according to Fig. 1 lies in:

- design of captive guides, position *1* and *3*. Guides are mounted on the shearer's reduction, that is the feed mechanism, towards the powered support (mined out space). This involves substitution of existing sliding captive guides on the shearer. The recently adopted solution does not require modification of the rack on the conveyer, therefore the solution of the producer is not modified, it being the path for the roller of the guidance;
- replacement of hydraulic cylinders (jacks) of the guidance skids from the face side with fixed elements, position *2*, mounted on the reducer and position *4*, mounted on the feed mechanism. The use of fixed elements removes the associated hydraulic circuit, the general hydraulic layout on the shearer is simplified, and the possibility of defaults is eliminated;
- design of traction chain fastening elements, at the two ends of the conveyer, position *5* at the end of the return end and position *6* at the driving end. This is necessary, since the conveyer, designed for a rack feed system, has no such elements.

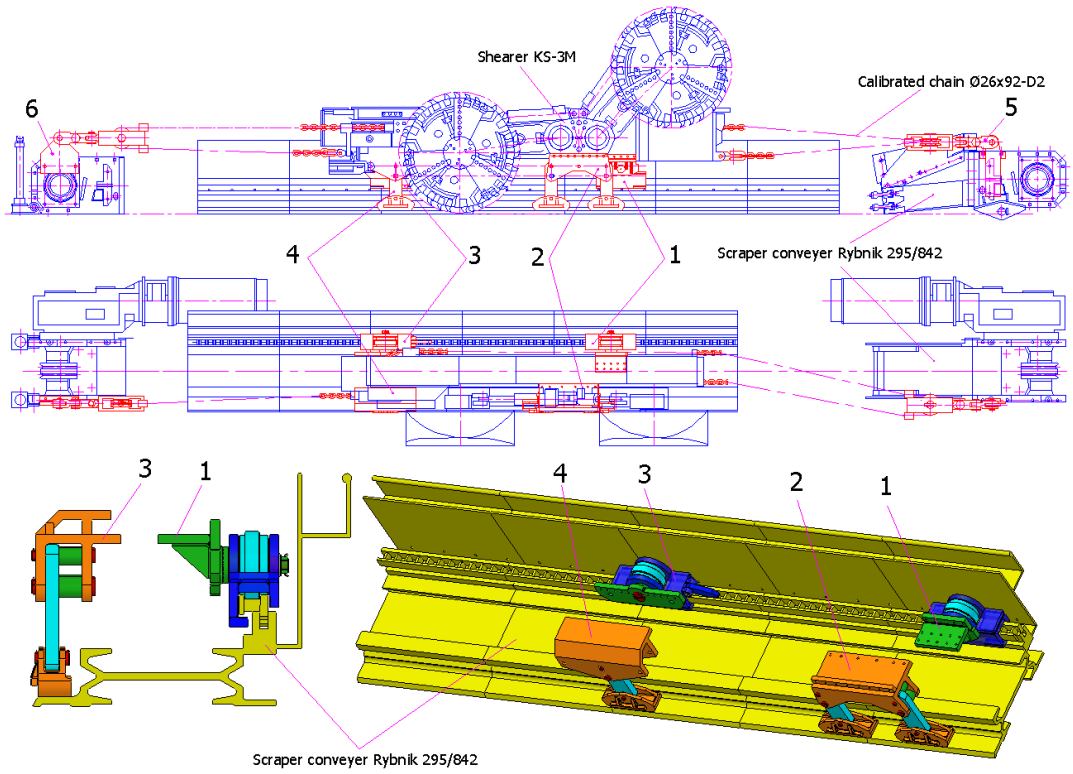

Fig.1. KS-3M feed system for Rybnik 295/842 conveyer

The overall design solution mounted on the shearer reducer towards the mined out space is given in Fig. 2. The main components of the guide are the roller support, the roller bolt, the guide, the roller with its associated elements for mounting and sealing the rolling bearing.

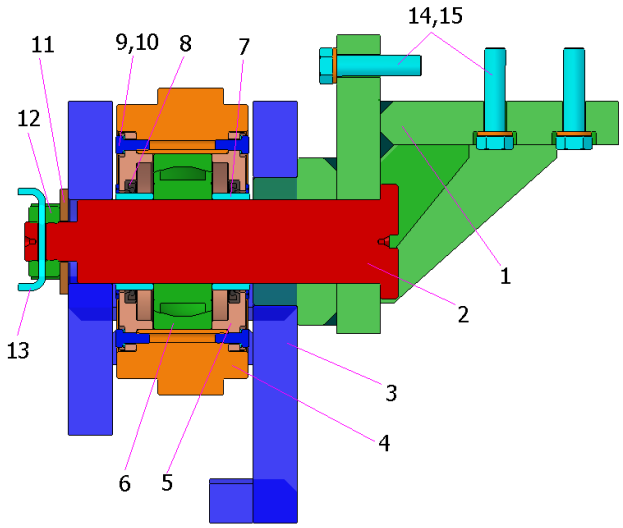

Fig.2. Overall solution for roller guide mounted on the reducer

The entire structure of the guide is mounted on the body of the principal reducer of the shearer by the roller, position *1*, and fifteen M24x1000 screws and of Grower disks, positions *14* and *15*. The roller support is a welded structure allowing its fastening to the reducer by one hundred M24 screws vertically mounted from the downside of the shearer and five screws horizontally mounted from the lateral side of the reducer. The use of 15 screws for fastening the guide is explained by the fact that it is mounted in the area where the larger weight of the principal reducer is concentrated and of the drving reducers of the drums.

The guide components are assembled with a Ø95 bolt, position *2*, ensured by the disk, position *11*, an M45x3 nut, position *12*, and a blocking wire of the nut, position *13*. Due to the mounting conditions of the bearing, position *6*, and spacer collar, the outside of the bolt is in k7 field of tolerance. The bolt rests on a the guide roller by a F8/k7 adjustment, position *3*,

providing in the same time a captive guide, guiding the shearer on the conveyer.

The roller, position *4*, representing the essential element in the structure of the guide, is equipped in the inside, by its cover, position *5*, with a spacer, position *7*, M12x30 screws and associated Grower disks, positions *9* and *10*, oscillating ball series 22319, position *6*, and sleeve B110140, providing the lubricating room of the ball.

The overall design solution of the roller guide mounted on the feed mechanism of the shearer, towards the mined out space is shown in Fig. 3.

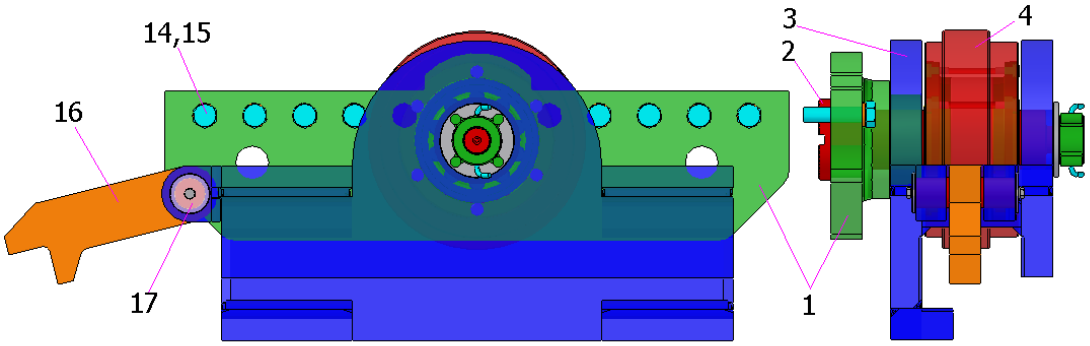

Fig.3. Overall solution for the roller guide mounted on the feed mechanism

The construction solution of the guide is identical to that of the roller guide mounted on the reducer, with two differences.

The first is connected to its fastening to the feed mechanism which has an other configuration and requires an other support type for the roller, position 1.

The support is fastened to the feed mechanism with ten M24 x 100 screws.

The second difference relates to the equipping of the guide with a click, position *16*, mounted by a bolt, position *17*, to the body of the guide, with safety role in the movement of the shearer.

Skid components at the face side, mounted to the shearer reducer, are presented in Fig. 4.a.

Modification of this movement system lied in replacing the two hydraulic cylinders (jacks) with two fixed linking plates, position *1*, two types of spacers, positions *2* and *3*, to make the structure rigid.

The other components of the system were kept, that is the reducer support, position *6*, skids, position *7*, Ø50 and Ø70 diameter bolts, positions *8* and *9,* for which blocking wires were provided, positions *4* and *5*.

Fig. 4.b gives the overall solution for the skid mounted to the feed mechanism.

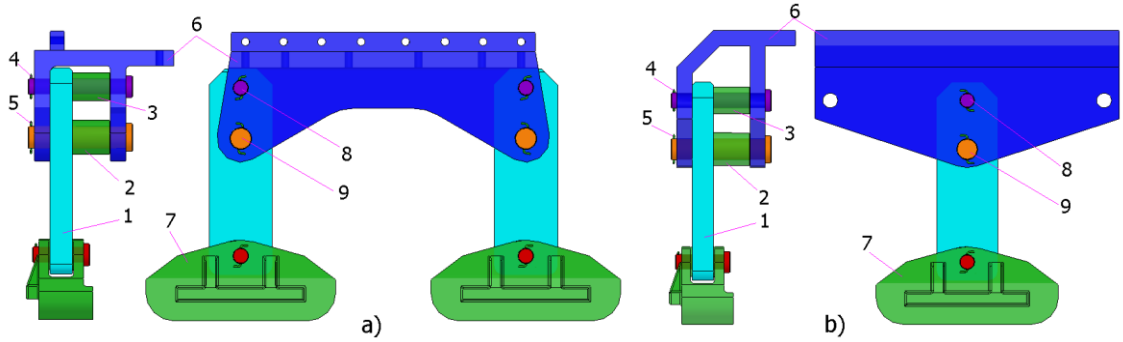

Fig.4. Modifications in the structure of the skid at the front mounted on the reducer and the feed mechanism

Fig. 5.a shows the overall solution for the modifications made at the connection between the feed mechanism chain and the metal structure of the return station of the conveyer.

The connection solution for the connection of the chain to TR-7A conveyer, position *1,* verified in practice, is kept, but the linking plate was provided, position *2*, mounted through two M36x200 screws, nuts and Grower disks, positions *3, 4* and *5*, on the metal structure of the return station.

The element supporting the chain and ensuring change of direction is coupled with the linking plate through Ø74 bolt, position *6*, provided by a blocking wire, position *7*.

The overall solution of modifications made at the connection between the feed mechanism chain and the metal structure of the conveyer driving station is given in Fig. 5.b.

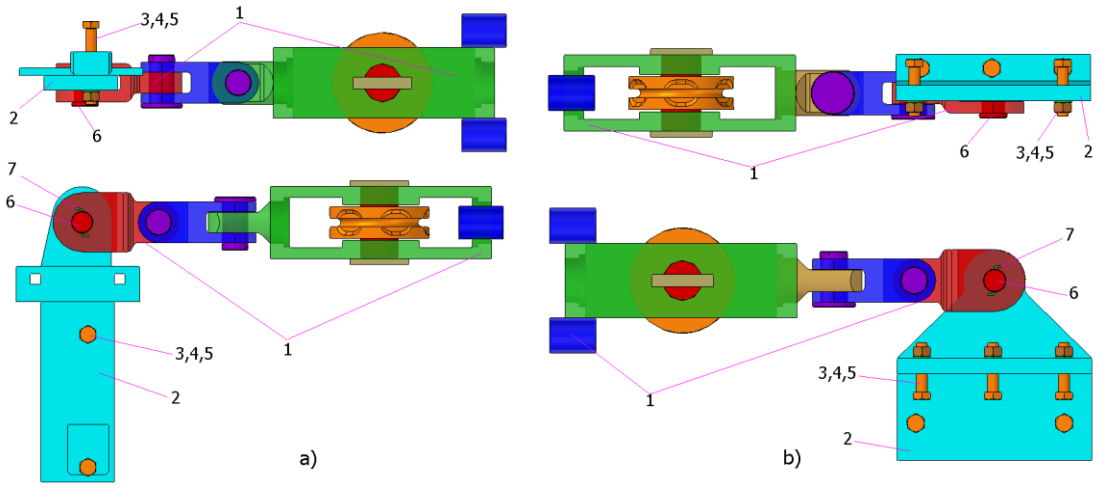

Fig.5. Design solution to link feed mechanism chain to conveyer driving station and conveyer return station

3. VERIFICATION OF THE SLIDE SUPPORT, ROLLER SLIDE AND BOLT ASSEMBLY

Feeding system elements were geometrically modeled by Solid Edge soft and analyzed by numerical method of finite element with COSMOS Design STAR soft, as it follows.

Fig.6 shows discretization, fixing and loading the assembly made up of slide support, which is fixed on the body of the shearer's reducer, roller slide and Φ 95 bolt, making the roller support and the positioning of the latter and of the slide to the support.

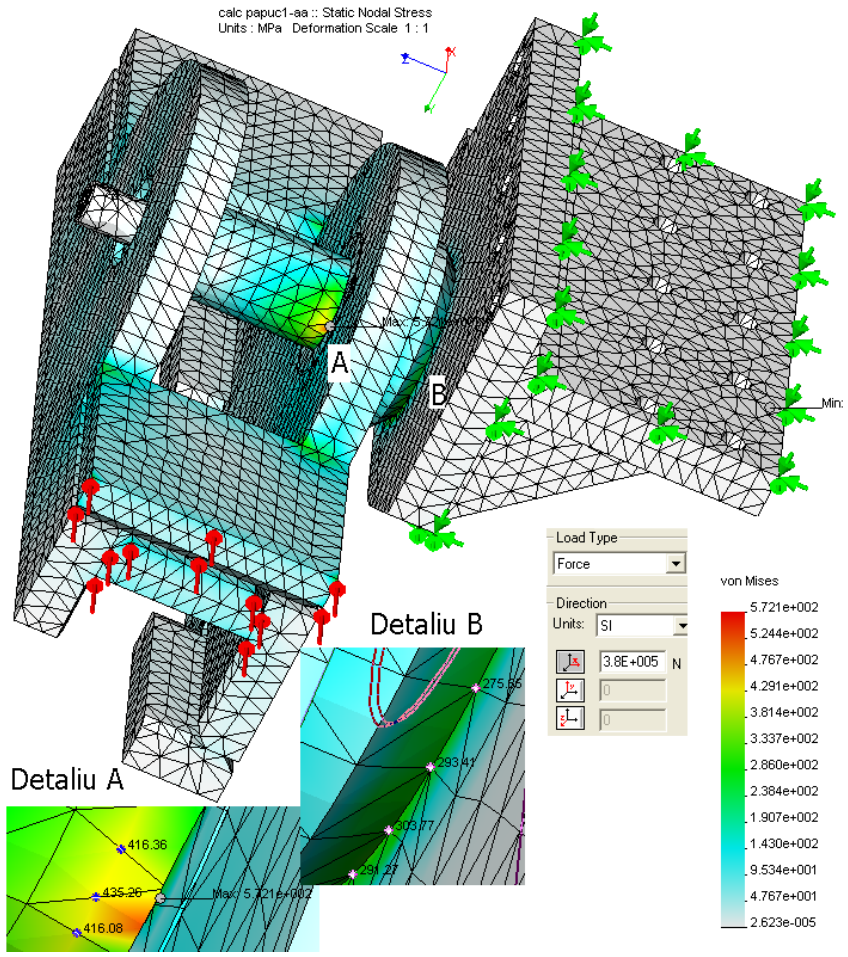

Fig.6. Verification of the slide support, roller slide and Φ95 bolt

The analysis was made for emergency, when the slide is blocked on the rack.

In this modelling, the bolt is tightened, therefore it takes over the transmission forces from the slide to the support, having in the bearing area a maximum pressure of 572,1 MPa (Detail A), and in the area of bearing - support a maximum pressure of 303,77 MPa (Detail B). These pressure values are not higher than resistances to tear.

4. CONCLUSIONS

The following conclusions resulted from the solutions developed to modify KS-3M shearer feed mechanism adapted to Rybnik 295/842 conveyer, used in Paroseni Mine face, panel 4, seam 3, block VI, slice 1, meeting occupational health and safety requirements:

- the feed system applied did not modify the technological operating and deployment parameters of KŞ-3M shearer and Rybnik 295/842 conveyer;
- the technical solutions meet health and safety requirements;
- replacement of sliding captive guides at the mined out space, applied for TR-7A conveyer with roller captive guides reduced friction in the guides and improved the power coefficient of the shearer used to cut coal;
- replacement of skid hydraulic jacks at the face side with fixed elements resulted in lower adjustment possibilities of the shearer position as to the conveyer, but it increased in the same time the reliability of the sliding skid movement system;
- the use of three sliding skids instead of two, as in the former feed system, contact pressure value between the skid and the , and the wear and shearer traction force, respectively, reduced;
- tension value in the component elements of the roller guide assembly of the KS-3M shearer feed system adapted to Rybnik 295/842 conveyer are no higher than tear resistance values.

The following design improvements are suggested, analyzing the technical solution found:

- roller without guide bed to remove double guidance on the rack (both by rollers and by captive guide);
- to improve mounting conditions for the roller in guidance and support, instead of the two spacer collars, a roller wide sleeve should be used where a radial-axial ball should be mounted, with 23222 barrel rollers, of higher dynamic capacity than the present ones;
- a centering bed should be implemented on the guide sleeve and a seating on the vertical plate to improve the positioning of the two elements and the way of force transmission from the roller guide to the support fixed to the shearer;
- welding some teeth to the periphery of the feed guide roller to clean the rack

Recommended for publication
of Editorial board

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