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LIFETIME PROLONGATION OF BELT CONVEYOR'S DRUMS BY DESIGN CHANGES

ZVÝŠENÍ ŽIVOTNOSTI BUBNŮ PÁSOVÝCH DOPRAVNÍKŮ ZMĚNOU JEJICH KONSTRUKCE

Abstract

Belt conveyor's drums are the most important parts of all belt conveyors. We sorted drums to two main sorts: drive drums or driven one. It is evident, that most loaded drums are drive drums, which transfer not only forces on drum faces area (belt forces), but mainly provide transfer of torque moment to belt or take up element and load of power units too. Well, commonly happen destruction of relatively low loaded driven drum of the belt conveyors mainly thank to no very good their design.

Abstrakt

Bubny pásových dopravníků patří mezi stěžejní prvky celého tohoto strojního zařízení. Rozlišujeme dva typy bubnů, kterými jsou hnací a hnané bubny. Je zřejmé, že nejvíce namáhané jsou hnací, které kromě přenosu sil v rovině čel bubnu, zajišťují přenos kroutícího momentu na pás, respektive tažný element a také zatížení od zavěšených poháněcích jednotek. Běžně však dochází k destrukci relativně méně namáhaného hnaného bubnu především díky jeho nevhodné konstrukci.

1 PROBLEM ANALYSE

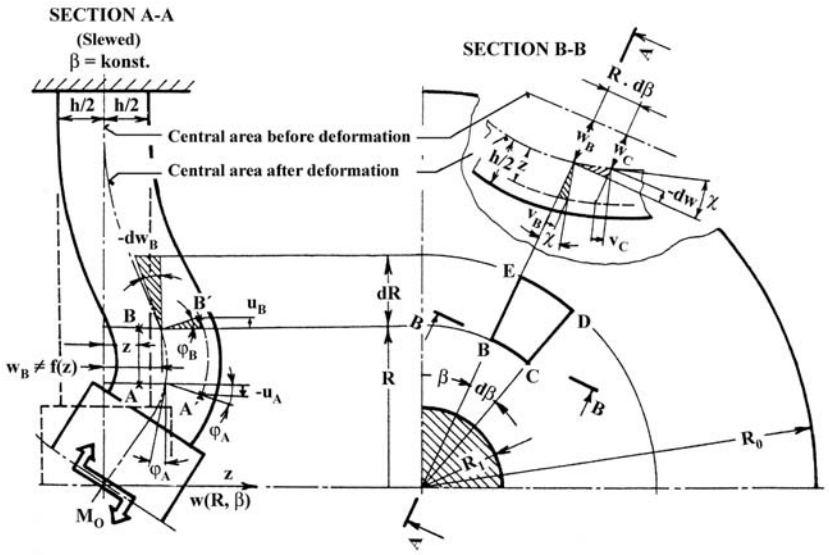

Fig. 1 Duress between face and hub of drum

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One reason from others of belt conveyor drums deformations and their successive destructions is solid duress between drum's faces and drum's shaft (figure 1). Thanks to the duress happen to considerable cyclical stress mainly in welds areas – connecting of faces with shaft or hub fixed on shaft respectively and between faces and drum's shell of course. There are places with start reactions of chaps which lead to mentioned destruction of conveyor drums.

2 SOLVING OF THE PROBLEM

It is very simple solving the problem about driven drums of belt conveyors and eliminating the undesirable duress by bearing using. Bearings, which are located on shaft ends together with bearing housings and are parts of the whole return station's frame we replace between face (hub) and shaft of the drum (figure 2). Thereby we disturb duress and will not happen to face bending caused by shaft deflexion and welds not will be over loaded.

It is logical, that the solving is not applicable on drive drums, because the drums have to provide transfer of torsion moment to drum's shell and in form of tensile force to conveyor belts.

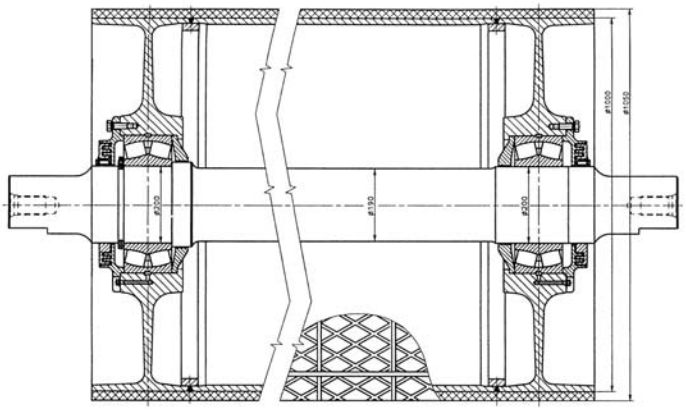


Fig. 2 Driven drum with bearing under faces

For conveyors with relatively small load, and all other equivalent parameters, up to 10 kW, problem can be solved by electro drums, which are drums with built-in electromotor (figure 3). It can't be used for more powerful conveyors and in the case not solve the problem.

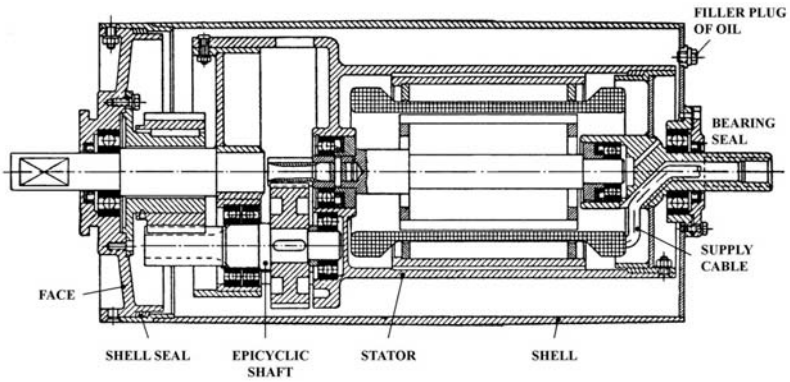


Fig. 3 Electro drum for small load conveyors

Partial solving of the problem could be viewed in better constructional bearing placing, more close to face of drum. Thereby the bending moment caused by tensile forces in belt of conveyor will be smaller then upon big distance of bearing housing from face. From whence it follows that faces will be loaded by smaller bending moment too (figure 4).

To radical solving of the problem we have to find better drum design, which solves - removes the duress between face and shaft together with providing of torque moment transmission. Thereby we prolong drum lifetime and lifetime of whole machine of course.

The mentioned solving is insertion of swivel bearing or of ball joint between face (hub) and shaft of driving drum together with toothed clutch or similar device (figure 5).

The bearing transmits radial forces (forces in belt of conveyor and mass of driving units) and toothed clutch mainly torque moment. Thank to possibility of the clutch to slew its both together catching part up to 2,5° without influence to torque moment transmit, we relieve drum's face, which not will be loaded by additional bending moment from shaft deflection.

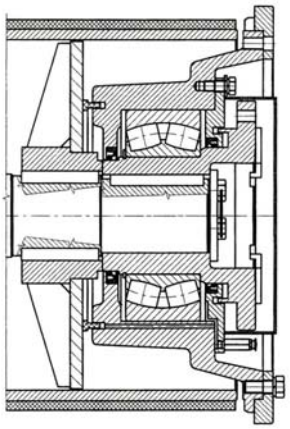


Fig. 4 Drum with better bearing placing

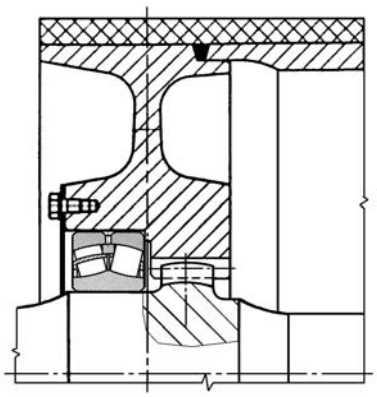


Fig. 5 Possibility solve the duress

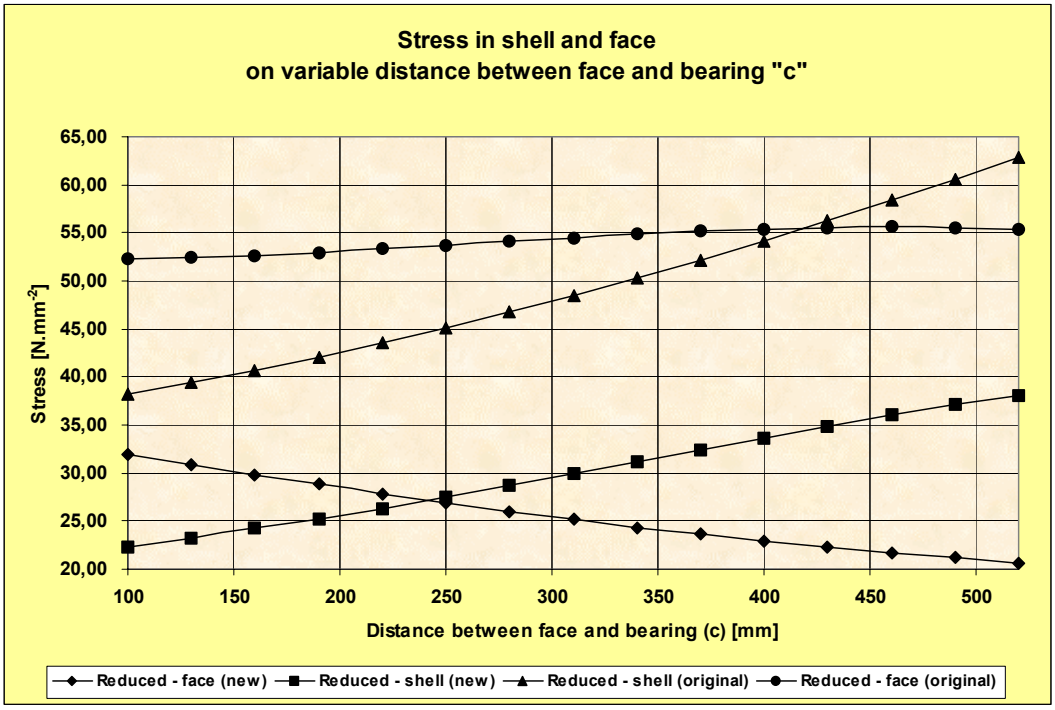
Another advantage is possibility to weight decrease of drum's shaft, because its part between faces could be with lower diameter. Just now, if we used bracing rings, we have to guarantee maximum wind up of shaft cross-section under the rings up to 3´ and thank to it, the shaft between the faces must be with slightly big diameter. I aware of bigger manufacturing costs of new type driving drum, but middle and more powerful drums with larger diameter (over 1200 mm) is the solving more profitable and the drums have longer lifetime and are lighter. We save about 3500 kg on central shaft part (only between faces) upon used the solving on middle powerful drums. Savings are bigger in reality.

3 CONCLUSION

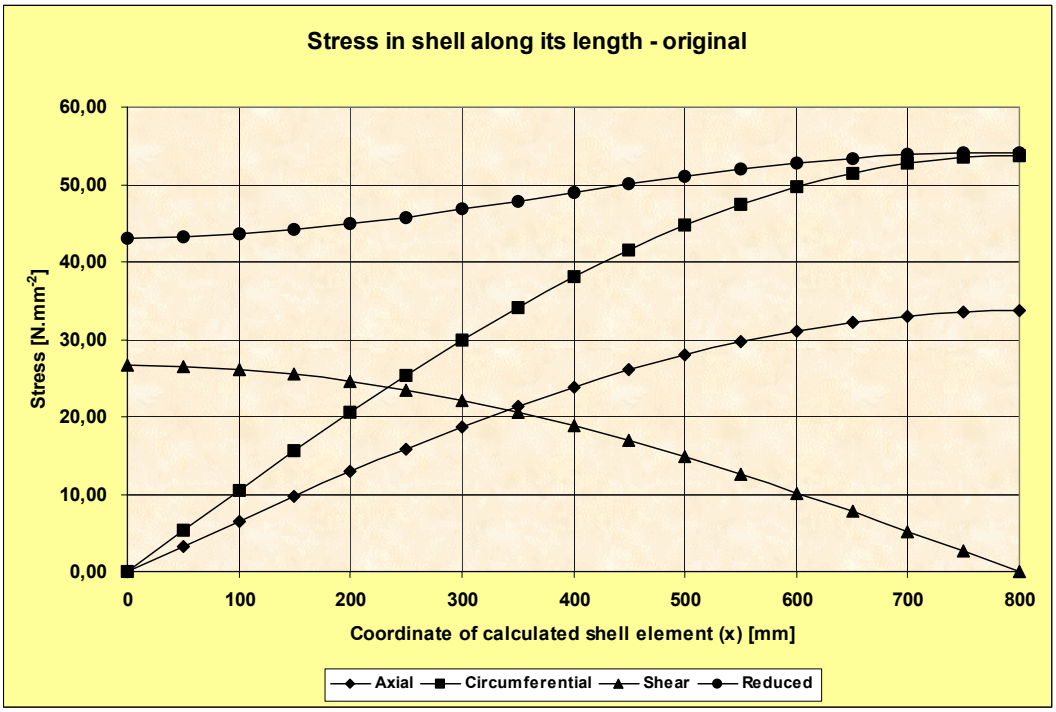
From the mentioned and lower showed graph is evident prolongation lifetime of new type – designed driving drum of belt conveyors.

LITERATURE

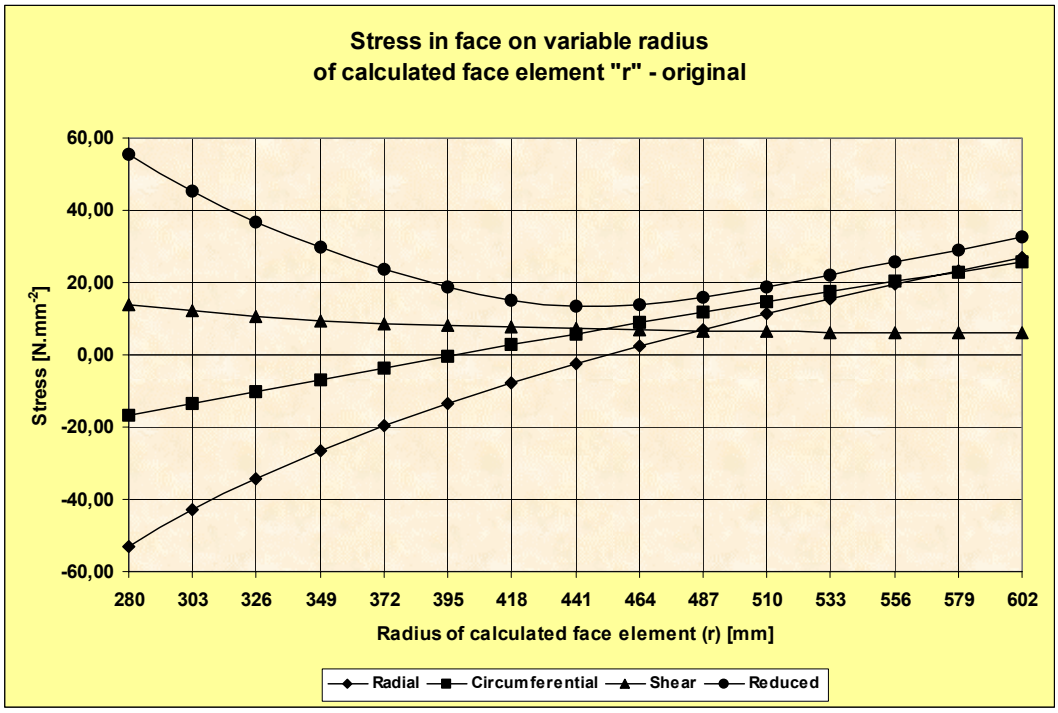
[1.] FRIES, J.: *Konstrukční řešení bubnů pásových dopravníků a jejich výpočet*. Ediční středisko VŠB-TU Ostrava, Ostrava 2003, str. 121. ISBN 80-248-0484-0.



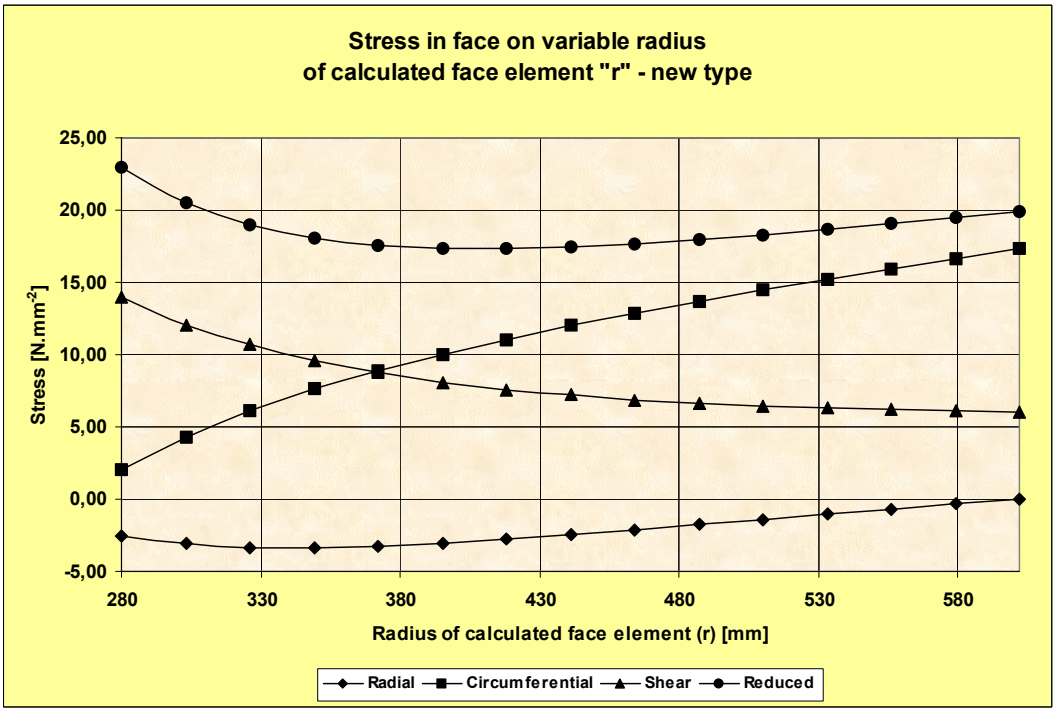
Graph 1 Stress in shell and face on variable distance between face and bearing



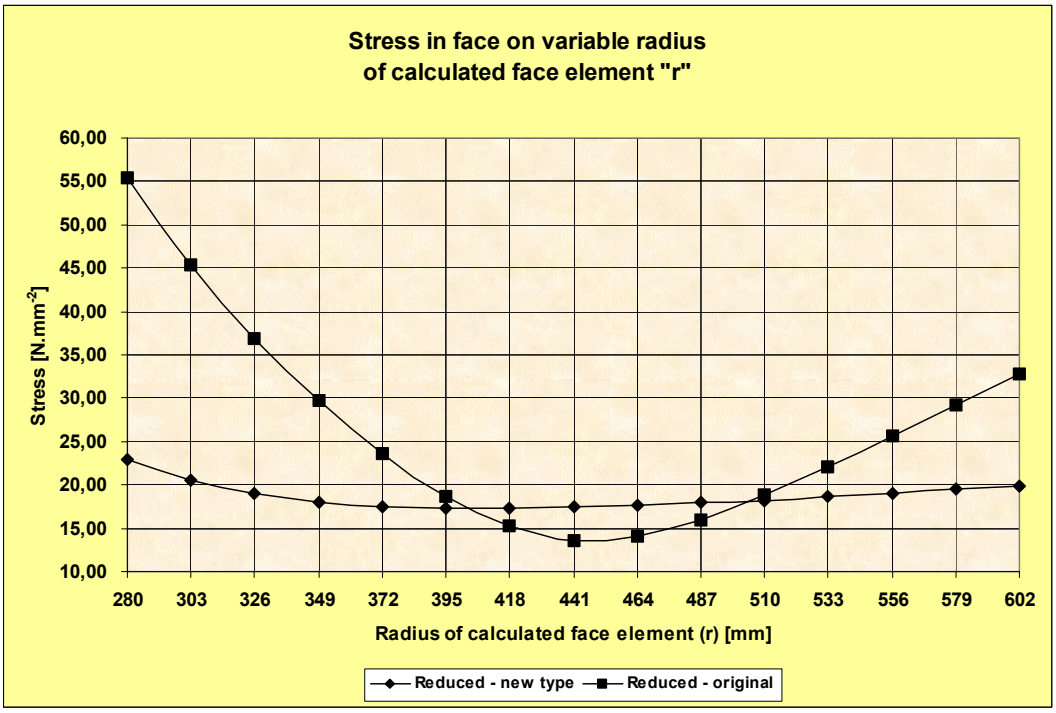
Graph 2 Stress in shell along its length – original



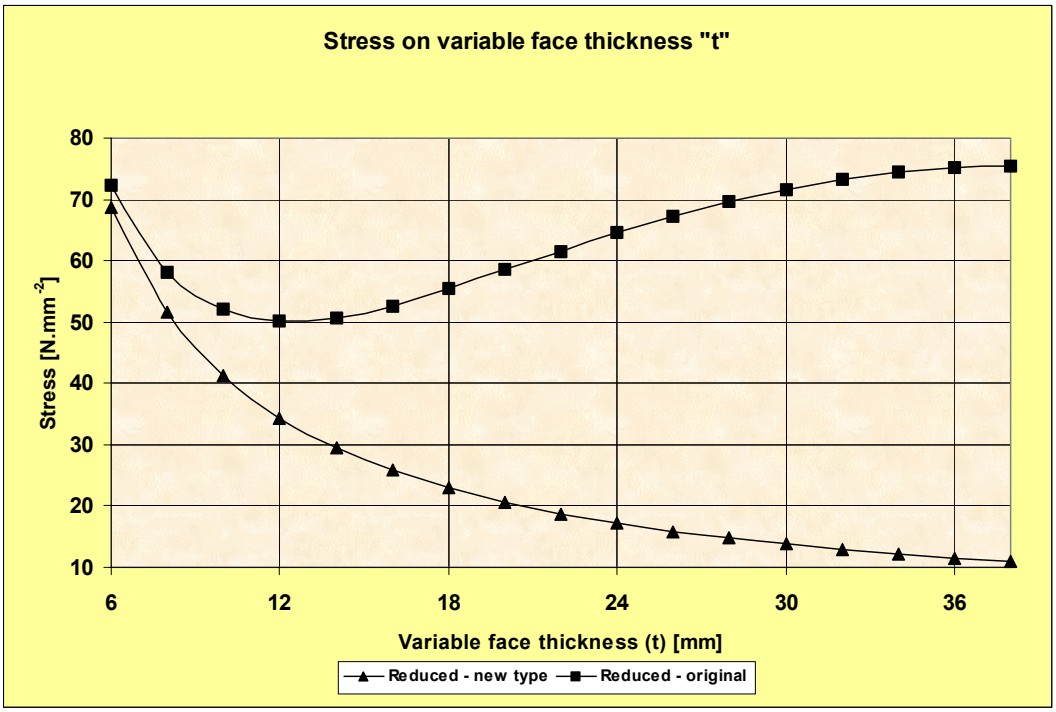
Graph 3 Stress in face on variable radius of calculated face element "r" - original



Graph 4 Stress in face on variable radius of calculated face element "r" – new type



Graph 5 Stress in face on variable radius of calculated face element "r"



Graph 6 Stress on variable face thickness "t"

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