Transactions of the VŠB – Technical University of Ostrava, Mechanical Series
No. 1, 2010, vol. LVI
article No. 1745

Jiří FRIES*

LIFETIME OF BELT CONVEYOR'S DRUMS DEPENDANCE ON OUTSIDE INFLUENCES

ŽIVOTNOST BUBNŮ PÁSOVÝCH DOPRAVNÍKŮ V ZÁVISLOSTI NA VNĚJŠÍCH VLIVECH

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 thanks to no very good their design.

Abstrakt

Prokluz pásu na poháněcím bubnu pásového dopravníku je všeobecně považován za nežádoucí jev, který má obrovský vliv na opotřebování obložení hnacích bubnů popřípadě na jejich destrukci a snižuje provozuschopnost celého zařízení a měl by být z provozu pásového dopravníku zcela vyloučen. Prokluzy pásu ve fázi rozběhu mohou být dlouhodobé nebo krátkodobé s nepatrnými rozdíly rychlostí pásu a poháněcího bubnu a nelze je tedy registrovat. Možnosti zamezení prokluzu je proto nutné hledat v řízeném rozběhu pásového dopravníku. Uvedený článek naznačuje vlivy jednotlivých vstupních parametrů dopravníku na vznik zmíněných negativních prokluzů.

1 INTRODUCTION

At the lifetime area of drums is more important, except drum design, mainly tensing devices and its reliability and effectiveness respectively. The devices at dependence conveyor infilling volume are able to influence not only drums lifetime, but other conveyor parts too, such as driving units etc. Insufficient tensile force and tensing device effectiveness happen slip of conveyer belt on driving drums, where along catching repeating by drum's shell, at belt running-on place happen rising volume of immediate approaching force in the place up to 4 to 7 fold of nominal force volume.

The increased force is not transmitted along conveyor, thanks to its fast absorbing. It has very big influence to drum lifetime (mainly to shaft lifetime) and to separate gear boxes and gear grades and other conveyor parts. Well, the biggest danger represent for belt mechanical joints, which are near to running-on place of belt on drum.

2 SIMULATION OF STARTING

Slip of conveyer belt happened on driving drum during operation, mainly during start-up phase of belt conveyor. On figure number 1 are showed time behaviours of approaching force (T_1), tram force (T_2) on driving drum of concrete conveyor. On figure number 3 behaviours of transmission capability of driving drum F_{rp}. Conveyor is 800 m long and flat laying (with zero exaggeration) and full loaded. Belt prestress (T_p) was gradually decreased from z 320 kN to 240 kN. Slip of conveyer belt starting at the moment, when volume is minus ($F_{rp} < 0$) and last till to plus volume. It is evident, that with the mentioned conditions we are able starting-up the conveyor without slips only with higher belt prestress then $T_p = 320$ kN. Each slip evokes another loading of driving units mainly by dynamic impulses. The worsened conditions have direct influence to separate belt conveyor's

* doc. Ing., Ph.D., VSB – Technical University of Ostrava, Faculty of Mechanical Engineering, Department of Production Machines and Design, 17. listopadu 15/2172, Ostrava-Poruba, tel. (+420) 59 699 4207, e-mail jiri.fries@vsb.cz

components including drum lining. During belt prestress decreasing under T_p= 270 kN happened to permanent belt slipping ($F_{rp} < 0$), what is inadmissible (figure no. 2).

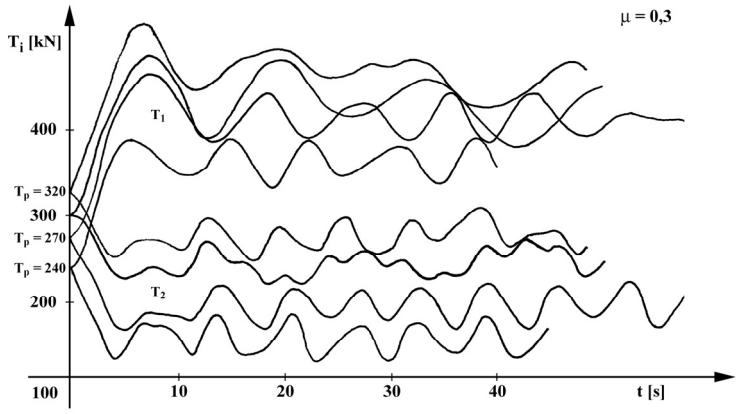

Fig. 1 Time behaviour of running on and running away force of driving drum – full loaded

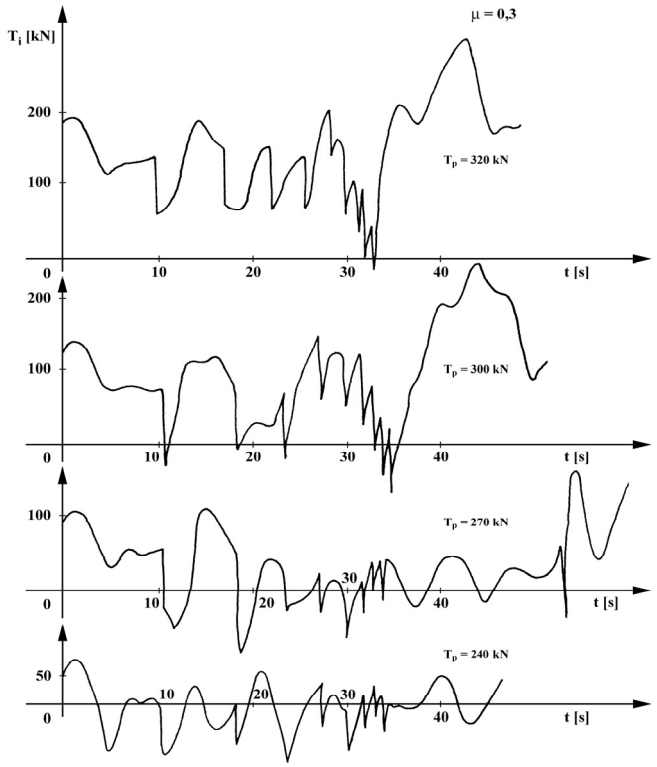

Fig. 2 Time behaviour of driving drum transmission capability – full loaded

On figure no. 3 are showed again time behaviours of approaching force (T_1), tram force (T_2) and behaviour of transmission capability F_{rp} on driving drum of conveyor length 800 m, flat laying, with zero exaggeration respectively (full loaded) for decreasing number of accelerating steps from 9 to 6. There is evident negative influence of the steps decreasing. Only with relatively strong belt prestressing to 350 kN belt conveyor have been running-up with a few small slips of conveyer belt.

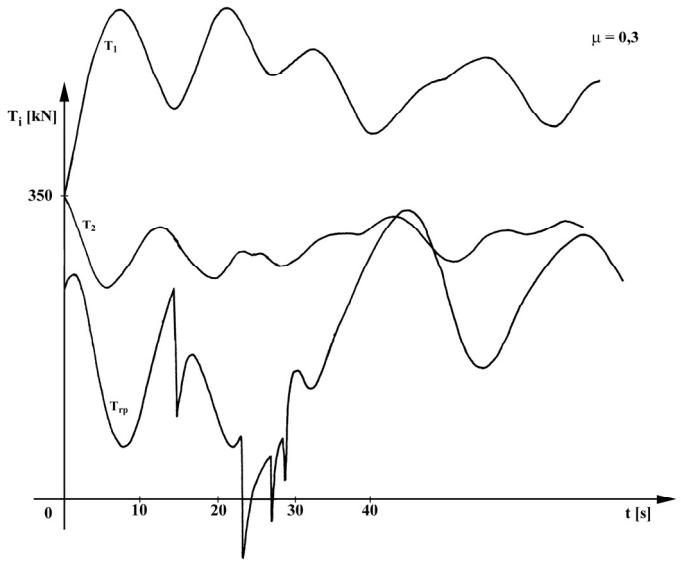

Fig. 3 Start up parameters of horizontally laid conveyor for 6 start up steps

3 CONCLUSIONS

Sum of the start-up simulation results of belt conveyor:

- Slip of conveyer belt is able on specific conditions evoke part belt wobble near to driving drum at the upper and bottom strand or between driving drums. Slips are strong silenced and along the conveyor are not distributed.
- Biggest dynamic shocks not arising during self slipping, but at the catching moment of belt on driving drum's shell. On specific conditions belt is not catching at once, but it several times shortly slips again. It arise considerable dynamic shock at transport band, load-bearing structure, driving units, clutch, gear box and mainly at driving drum, what can be fragmented, especially its shell.
- During simulation was determined 4,6 fold of belt force at upper strand compare to immediate traction volume after slipping. Gear box loading oscillated to mines volumes.
- Thanks to random arising of dynamic shocks, we can't count with them in the conveyor operation and with their frequently presence. But, if they arise, they can be reason of mechanical joints destruction, be situated near to driving drum.
- Solution can't be founded at conveyor dimension, but mainly at designing and using of sophisticated conveyor regulation. Regulation of conveyor operation with slipping reaction on driving drum is unsatisfactory.
- For accurate conveyor dimensioning we need not only static evaluation, but mainly dynamic models or develop and used sophisticated regulation systems.

This project was realized thanks to financial support from the means of state budget by means of the Ministry of Industry and Trade (FT-TA4/018).

REFERENCES

[1] TOUŠEK, E. *Prokluz pásu na poháněcím bubnu pásového dopravníku*. Kandidátská práce. ČVUT Praha, Praha 1985. 145 p.

[2] FRIES, J. *Pásové dopravníky, bubny a jejich výpočet.* Ostrava: Ediční středisko VŠB-TU Ostrava, 2009. 189 p. ISBN 80-248-0484-0.