Mariusz Dąbrowski

SUMMARY OF DOCTORAL DISSERTATION

"Analysis of the influence of cutting conditions on accident hazards associated with kickback in milling wood materials"

An analysis of accidents has shown that most fatal injuries during woodworking result from kickback. Kickback is often an indirect cause which initiates a sequence of events leading to serious injuries. In its Code of Practice, the International Labour Office recommends that „where the machinery is likely to be used in conditions involving the risk of ejection of work pieces or parts thereof, it should be designed, constructed or equipped in such a way as to prevent such ejection or, if this is not possible, in such a way that ejection does not pose a risk to the workers".

The aim of this dissertation was to determine the influence of cutting conditions on hazards associated with kickback in milling wood materials. The speed of kickback was accepted as the quantitative measure of these hazards. This project consisted in developing an original method of kickback experimental testing, building a unique research test stand and developing an original method of measuring the speed of kickback with a high-speed camera and a computer program for evaluating registered images. This measurement method has proved to be very precise and insensitive to wood chips and dust, which had been the main difficulty in earlier experiments.

All tests were conducted during stopped straight milling on a conventional vertical moulding machine without a mechanized feed. The speed of kickback of the workpiece was measured in different cutting conditions. The experimental involved controlled changes in basic factors (cutting conditions, which were the independent variables), such as the type of cutting tool, machined material, cutting speed, number of cutting blades, projection of cutting blades over the body of the milling tool, abrasion of blades and clearance angle.

Multi-factorial analysis of variance was applied to the results of individual experiments. It showed statistically significance factors and their interactions. Their real influence-power, so-called the experimental effect size was also determined. Tukey's HSD post-hoc test was applied to compare pairs of intermediate speeds of kickback, which were observed for different levels of individual factors. Inspection and analysis of traces left by the cutting blades of the tools on the test pieces made of wood materials supported inferential statistics.

This complex approach made a much fuller description of kickback possible. It also helped to determine quantitative regularities during kickback and to suggest practical improvements in occupational safety during milling wood materials.