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CONDITION OF EDGES OF PARTICLE BOARD LAMINATED AFTER SAWS ON A PANEL SAW

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Abstract

The purpose of the work was to examine the impact of the change of the feed speed of the saw carton in the panel saw on the quality of the edge of laminated chipboard subjected to sawing. During the test, the feed values recommended by the saw and machine tool manufacturer were applied. The tests were carried out in two sawing variants: one by one and in a package of two boards simultaneously. The quality of the machining was determined based on the evaluation of the material edge condition, i.e. the size of the nicks. A package of two plates folded with wide surfaces was treated as one thick plate with a double thickness compared to a single plate. Based on the obtained results, it was found that the size of the cracks on the lower edges is several times greater than on the upper side of the sawed slabs. This statement is valid for all considered cases of sawing.

Key words: *sawing, cutting angle, machining quality, laminate, material feed*

INTRODUCTION

The basic material for furniture production is chipboard and MDF. Due to its unquestionable advantages, of which it is very important to refinish them (varnishing, laminating, gluing, filling etc.). However, as a rule, refined materials have a negative effect on the durability of the tools, causing them to be exterminated more quickly. Therefore, it is important to select the machining parameters to obtain the best possible surface quality with the least tool wear. One of the parameters determining the quality of processing is the amount of feed speed at which the sawing takes place[3,9,10].

In the era of searching for the possibility of increasing the productivity of used equipment, there are attempts at simultaneous machining of several boards allowing for increased sawing efficiency. However, this may lead to a reduction in the quality of the edge of the boards, especially laminated ones. The work was aimed at explaining the expediency of such proceedings.

In the case of sawing, which aims to divide wood and boards, two working movements must be met; rotational movement of the tool and feed movement of the material or feed table on which the material is placed [3,5,8,9,13].

Previous work devoted to the issue of increasing the efficiency of cutting laminated chipboard, investigated the effect of the speed of feed on edge quality.

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Close to the research problem

Deterioration of the machining quality during milling of chipboard [7,8,9,10,11], occurs as a result of increasing: blunt cutting edge, vibrations of the tool carriage, cutting speed when using high feeds per blade. Therefore, it is important to select the machining parameters to obtain the best possible surface quality, especially laminated boards, with the least possible tool wear [5,7,8].

In the era of searching for the possibility of increasing the productivity of the equipment used, attempts are made to simultaneously process several boards allowing for increasing the efficiency of work stations. However, this can take place with a reduction in the quality of the edge of the boards, especially laminated ones. This justifies the rightness of taking up this subject in order to clarify the problems mentioned.

METHODS AND MATERIALS

The wood-based material tested was chipboard laminated on both sides with papers saturated with phenolic resins (laminated chipboard) with a thickness of 18 mm and an average density of 658 kg / m^3 [15].

The apparatus used for the assessment of quality of processing

The Mitutoyo TM-505 workshop microscope with a measuring range of 50 by 150 mm was used to evaluate the quality of processing of the test material. Optical zoom of the microscope 30 : 1.

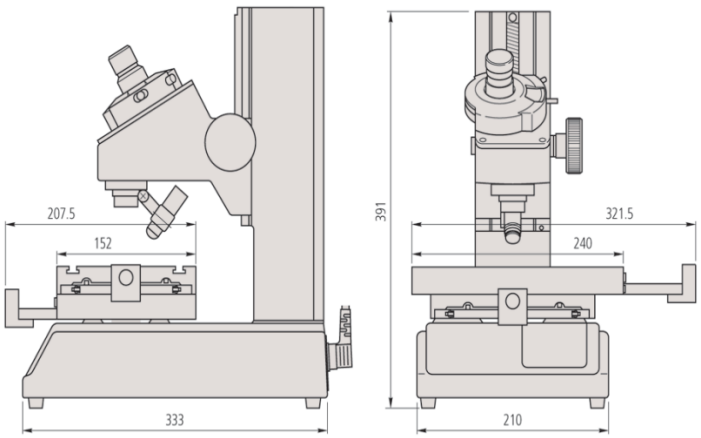

Fig.1. Mitutoyo TM 505 workshop microscope [http://www.mitutoyo.co.uk, 05.02.2017]

Machine tool and tool

The Holzma HPP 200 format saw was used for testing.

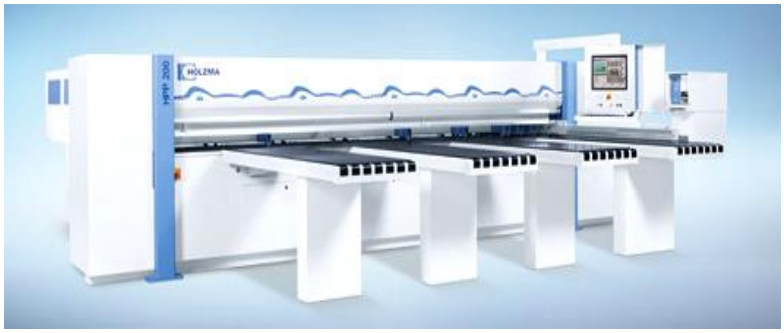

Fig.2. Holzma HPP 200 panel saw [http://www.holzma.com, 15.07.2017]

The cutting tool used was the main saw with a diameter of 310 mm with flat teeth and a undercut saw with a diameter of 200 mm with cone-flat teeth. The teeth of both saws were made of sintered carbides [4,14]. The condition of the machine corresponded to the standard PN-93/D-56216.

Tool

The cutting tools used were: the main saw 310 mm in diameter with flat teeth and the undercut saw with a diameter of 200 mm with cone-flat teeth. Both saws produced by LEUCO. The teeth of both saw blades were made of sintered carbides. The speed of the main saw spindle was 5677 rpm, while the undercut saw blade was 4371 rpm. The maximum height of the saw above the table was 60 mm. Despite the clearance for sawing three boards, the manufacturer recommends sawing with the saw being 25-40mm above the material, which means that only the sawing of a single slab would be carried out as recommended.

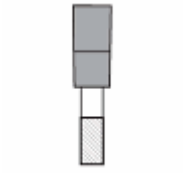

Fig.3. Main saw tooth [www.leuco.com, 10.01.2017]

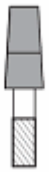

Fig. 4. Tooth saw blade

Sawing parameters used

The value of the feed speed was calculated using the formula:

$$v_f = f_z \,.\, n \,.\, z_c \quad [\frac{m}{min}],$$

where: v_f - feed speed
f_z - feed per blade
n - spindle speed
z_c - number of effective blades

The feed parameters were used for the test:

- minimum feed recommended by the saw manufacturer:

$$36{,}7\frac{m}{min} = 0{,}09\ mm \times 72 \times 5677\frac{obr}{min}$$

- maximum feed recommended by the saw manufacturer:

$$61{,}3\frac{m}{min} = 0{,}15\ mm \times 72 \times 5677\frac{obr}{min}$$

- maximum feed available on the Holzma HPP 200:

$$80\frac{m}{min} = 0{,}2\ mm \times 72 \times 5677\frac{obr}{min}$$

- comparative table example from the LEITZ catalog

$$24{,}5\frac{m}{min} = 0{,}06\ mm \times 72 \times 5677\frac{obr}{min}$$

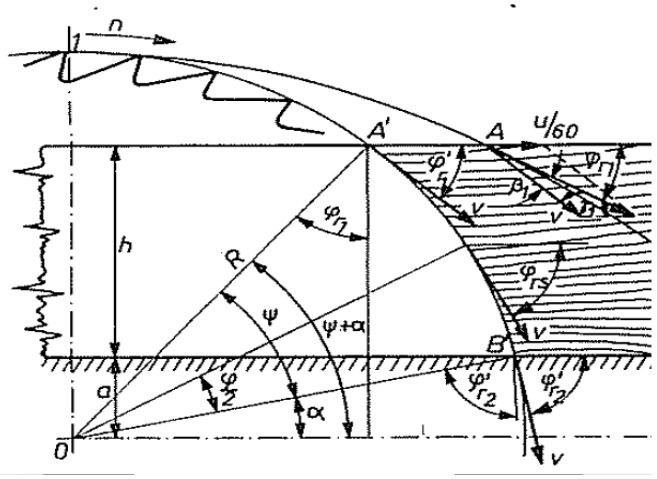

Fig.5. The sizes that characterize the saw system, the table, the saw element [2,6]

$$cos\mu = \frac{h+a}{R} \quad [°],$$

where:
h - directory wood kerf - cut height
a - distance of the element from the geometrical axis of the saw rotation
R - saw radius

- Saw tooth angle in the material when sawing a single plate:

$$cos\mu = \frac{18+95}{155} = 0{,}7290 \quad \text{czyli } \psi = 43°$$

- Saw tooth entry angle into the material when sawing two plate:

$$cos\mu = \frac{36+95}{155} = 0{,}8451 \quad \text{czyli } \psi = 32°$$

The value of the saw tooth's angle of exit from the material was calculated using the formula:

$$cos\mu = \frac{a}{R}$$

where: h – kerf
R - saw radius[°],

The value of the saw tooth angle of the material: dl

$$cos\mu = \frac{95}{155} = 0{,}6129 \quad \textbf{or} \quad \underline{\boldsymbol{\mu = 52°}}$$

Mesuring the quality of sawing discs

Measurements of the quality of sawing plates were made on a workshop microscope. To determine the amount of nicks in each sawing variant, the measuring section was divided into 10 parts.

Figure 7. The method of measuring the edge defects of the plate material after sawing

where: H - maximum crack size [mm]

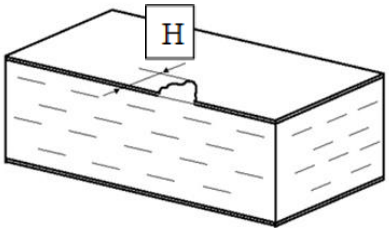

Fig.8. View of the edges of chipboard laminated with nicks

RESULTS and DISCUSSION

Tables 1-2 show the relationship between the feed speed and the state of the edges of wood-based boards after sawing with different packets of sawn slabs.

Tab.1. Nothing in the saw plate individually

feed speed [m/min]	The average value of nicks	
	the top edge of the board	the bottom edge of the board
	[mm]	
24,5	0,183	0,489
36,7	0,125	0,182
61,3	0,144	0,353
80	0,141	0,604

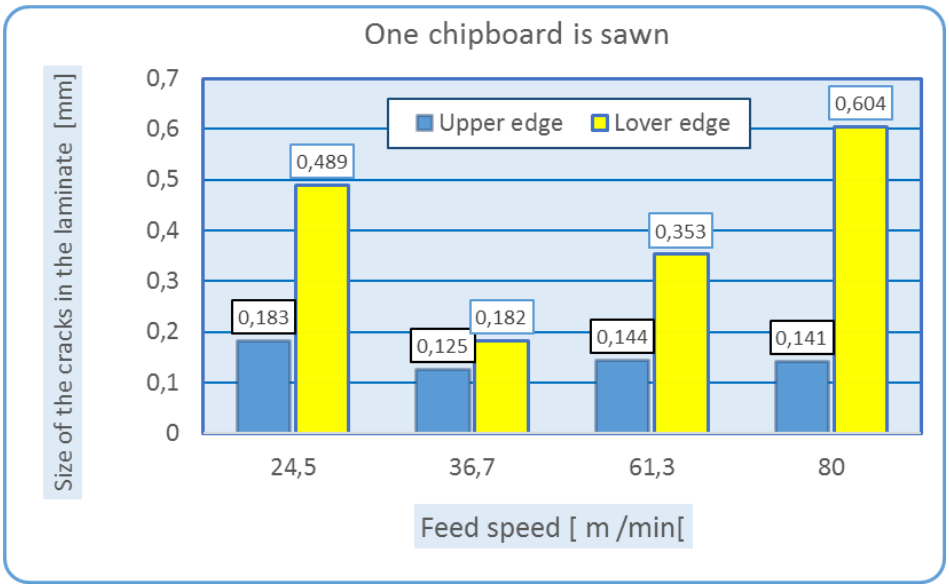

Fig. 9. Visualization of the results of inspection of sawing nicks indywidual plates

Tab. 2 Plates sawn in packages of 2 pieces

Feed speed [m/min]	The average value of nicks			
	The average value of nicks		the bottom edge of the board	
	[mm]			
	top edge	the bottom edge	top edge	the bottom edge
24,5	0,220	0,405	0,140	0,475
36,7	0,150	0,230	0,210	0,385
61,3	0,170	0,420	0,085	0,990
80	0,180	0,325	0,180	0,695

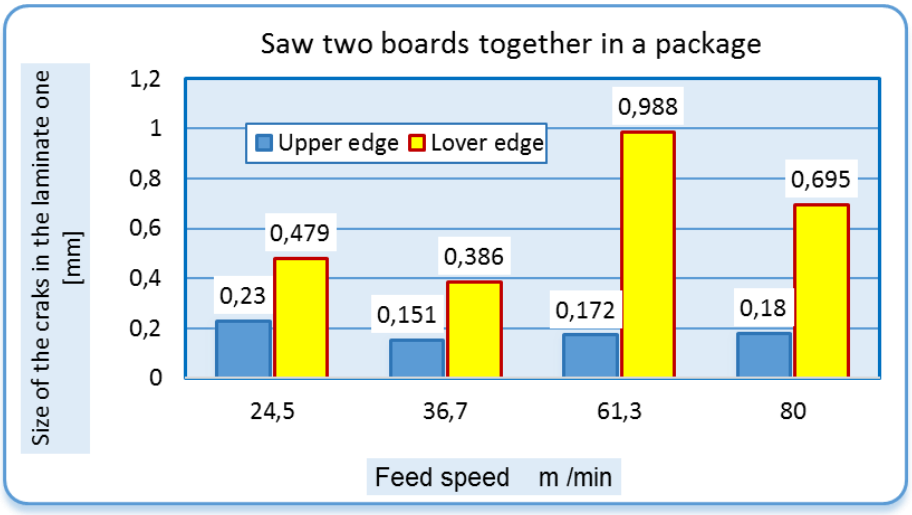

Fig. 10. The average value of nicks when sawing discs in packages of 2 plates

CONCLUSION

The best surface quality after sawing, in all variants, was obtained using the minimum feed recommended by the saw manufacturer - 36.7 m / min.
When sawing individually one laminated chipboard; significantly lower edge quality is shown by the lower edge than the upper edge, despite the use of the undercut saw.
After sawing the boards in packages of 2 pieces, the worst quality clearly differing from the rest showed the bottom edge of the bottom plate in the package. The values of chipping are several times greater than the edges on other sides of the boards. The upper edges of the boards included in the package have nicks close to each other. comparing the nicks of the plate cut individually with the bottom plate from the packet, we found similar values of chippings which would indicate the effect of sawing conditions on the final edge quality such as the angle of the tooth entry into the material and the angle of the tooth entrance into the material. The sawing speed promotes a good quality of the saw plate edges; the lower the value, the less jags it gives. The average value of nicks when sawing boards in packages of 2 plates is higher than when sawing in one plate at a time.

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