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NEW ASPECTS CONCERNING POSSIBILITIES FOR MONITORING OF DRILLING

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Abstract: *This paper offered analyses torque and thrust. Machine boring is a common operation whenever dowels, rungs or screws are used in assembling wood components. Holes are also required for bolted connections in poles, cross arms, trusses and structural beams.*
Key words: *Torque, Thrust, Machine, Wood, Components Rungs*

1. INTRODUCTION

Wood machining monitoring is one from the most important area for control of process in automatic production lines. The measure of feed force and torque offer possibilities for it. The aim of experiments was to design jig and create software for testing various technological conditions and different types of bits.
Theoretical cross section of chip for drilling with one cutting edge is maybe computed by equation:

$$A_{D1} = b_D \cdot h_D = f_n \cdot \sin K_r \cdot \frac{D_n}{2 \cdot \sin K_r} = \frac{D_n \cdot f_n}{2} \quad \textbf{(1)}$$

In case of bit with two cutting edges, for cross section of chip removed with one edge validates formula:

$$A_{D1} = \frac{D_n \cdot f_n}{4} \quad \textbf{(2)}$$

and sequentional cross section of chip removed with both edge will be:

$$A_D = 2 \cdot A_{Dl} = \frac{D_n \cdot f_n}{2} \quad \textbf{(3)}$$

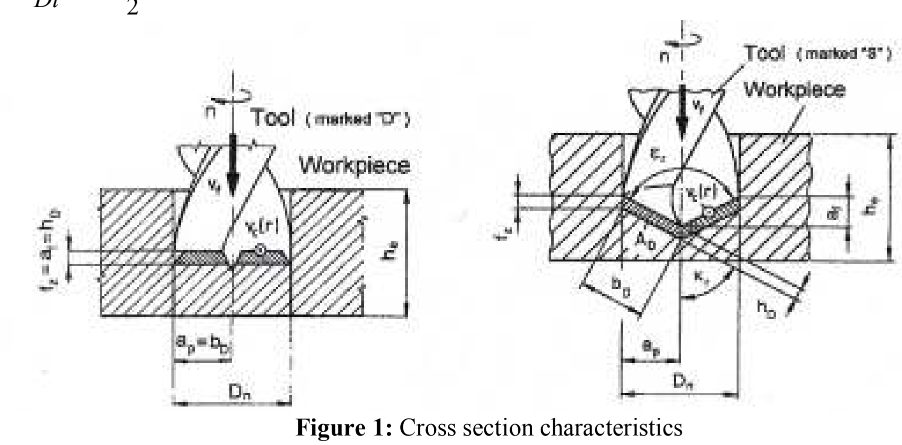

Figure 1: Cross section characteristics

Drilling comes under category of closed cutting. Computing of force parameters is very complicated for this ranks and is determined by experiment often.

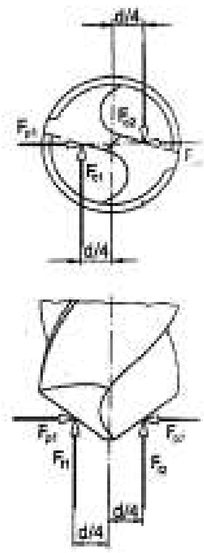

Figure 2: Forces

In generally, the tangential component of cutting force of which operated in arm d/4 validated:

$$F_{c1} = F_{c2} = F_c = K \cdot A_D = K \cdot \frac{D_n \cdot f_n}{4} \tag{4}$$

and for corresponding torque we can write:

$$M_{kz} = F_c \cdot \frac{D_n}{2} = K \cdot \frac{D_n^2 \cdot f_n}{8} \tag{5}$$

Value of total torque during drilling of deep holes consists from torque M_{kz}, for remove of chip, next from torque M_{kf} generated with friction between cutting facet and inside face of hole and torque M_{kt}, generated with friction of chip between flute of bit and inside face of hole.

$$M_k = M_{kz} + M_{kf} + M_{kl} \tag{6}$$

The components M_{kf} and M_{kt} are increasing with increasing of hole deep.
Empirical formula

$$F_{0f} = k \cdot F_c \tag{7}$$

is usually used for computing feed force F_{of} from force F_c.

Value of constant factor lies in a large interval; it depending e.g. from wear of cutting edge etc.
Likewise, values of total feed force consist to components:

$$F_{of} = F_f + F_{ff} + F_{fl} \tag{8}$$

2. CONCLUSION

From experimental works is evident influence of bit's diameter on both measure values, torque and feed force.

By formula (1) cross section doesn't depented on the angle of bevel, it would be means that tangential force (and torque) would not be depends on this one. From graph is evident a big influence of this one.

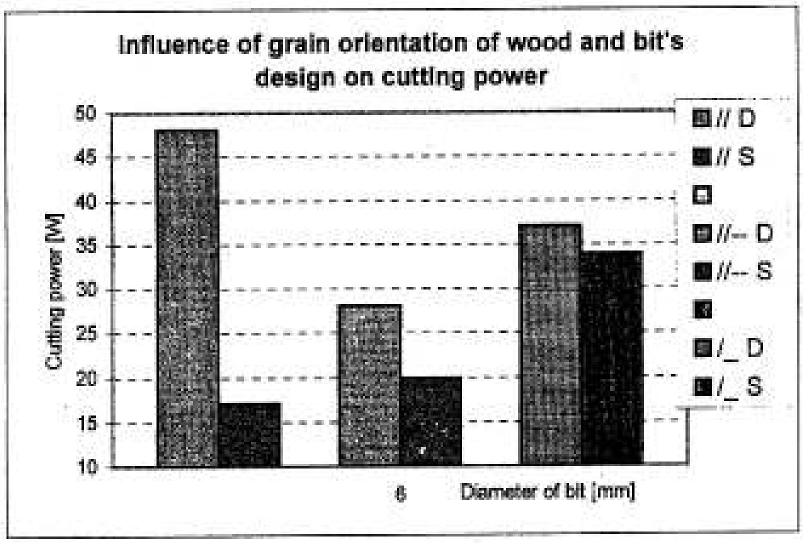

Figure 3: Influence of grain orientation of wood and bit's design of cutting power

If we compare type of drillings marked D and S, we can se, that cutting power needed for drill D is 2.8 times fighter than for drill marked S, and feed force. It is 2.7 times higher for drill D than fir drill S for longitudinal drilling. 1.5 more for cutting power and 2.3 more for feed force for tangential drilling; 1.12 more for cutting power and 2.0 more for radial drilling respectively.

If we compare influence of grain orientation to cutting power, than cutting power for longitudinal is needed 1.7 times higher than for tangential drilling and 1.3 more for radial drilling respectively. These values are validity for drill of type D.

3. REFERENCES

[1] Argyropouolos, G.A., Schleifen plattenformiger Werkstucke, AFW werbeagentur GmbH, Kassel

[2] Dogaru, V. (1981), Aschierea lemnului si scule aschietoare Editura Didactica si Pedagocica, Bucuresti

[3] Dogaru, V.(1985), Bazele prelucrarii mecanice a lemnului, Editura Didactica si Pedagocica, Bucuresti

[4] Maier, G.(1987), Holzbearbeitungsmaschinen, DRW-Verlag Stuttgart

[5] Radu A.(1977), Masini pentru prelucrarea lemnului. Editura Didactica si Pedagocica, Bucuresti