Some problems conected to feed movement at wood planing

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ABSTRACT

The technology of power transmission and feed speed variators currently offers many alternative solutions. The optimum choise can only be made after a detailed analysis, wich simultaneously with the new technical and technological options and the relevant price, has to be rewieved occasionally. The same aplies to the movement & power transmition and the feed speed power at wood planing. The paper deals with some problems occuring during exploitation of machines for planing in woodworking industry. The problems are coused by different rool speeds due to feed speed rolls wear. To prevent roll slip the use of feed rols with adaptible rotational frequency is suggested.

Keywords: *wood planing, feed speed, feed rolers wear*

Introduction

The wood planing efficiency depends mainly on its feed speed movement system. Moreover , the good control of the feed speed makes it posible to maintain the optimal working conditions and its fast change determines the machine's working dynamics. The feed movement at wood planing is usually performed by feed rolls. During workpiece feed movement at least two feed rolls are simultaneously in contact with it. The feed rolls are usually powered by single friction variator. The power transmission from the friction variator to the feed rolls is always realized by chain. On the feed speed rolls are fixed lančanici.With the same number of teeth. It means that their rotational frequencies are also the same. It is quite understandably that for the correct functioning of the feed movement the same peripheral speed of the feed rolls must be maintained. During machine exploitation the feed rolls wear appears. The wear intensity are different, specially on the feed rolls made from different materials. It means that after some time the peripheral speeds on the differnt feed rolls are different too.

The planing of the wooden workpieces during their movement through the machine working area could be performed with one or more planing heads. The position of the planing head axis could be above, below or on the both sides of the workpiece as it is shown on fig. 1. Depending on the planing head position different resisteces could occure during workpiece feed movement. The feed movement resistences are balanced with friction conditions between feed rolls and work piece. The three tipical cases may appear as it is schematically represented on fig. 2. It can be easily shown that the workpiece feed speed movement wil be constant only if the following conditions are satisfied:

- for the case *a)*:

$$F_v \geq \frac{F_{t\max} \cdot \cos\varphi + F_{o\max} \cdot \sin\varphi - \mu_1 (F_{t\max} \cdot \sin\varphi - F_{o\max} \cdot \cos\varphi)}{\mu - \mu_1} \qquad (1)$$

- for the case *b)*:

$$F_v \geq \frac{F_{t\max} \cdot \cos\varphi + F_{o\max} \cdot \sin\varphi - F_{o\max} \cdot \cos\varphi(\mu - \mu_1) + F_{t\max} \cdot \sin\varphi(\mu - \mu_1)}{\mu - \mu_1} \qquad (2)$$

- for the case *c)*:

$$F_v \geq \frac{F_{t\max} \cdot \cos\varphi - F_{t\max} \cdot \sin\varphi}{\mu - \mu_1} \qquad (3)$$

- where F_v is pressing force of the feed rolls, F_{tp} is the ortogonal force on the working table, μ is the fciction coefficient between feed rolls and working table, μ_1 is the friction coefficient between workking piece and working table, F_{rmax} maximum cutting force during cutting and F_{omax} maximum push force during cutting.

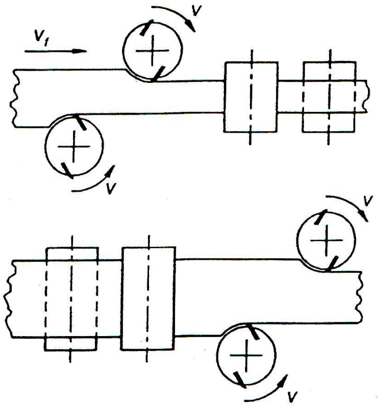

Fig. 1: The posible positions of the planing heads

In ocasion where no slip between feed rolls and workpiece occur, the feed speed will be the same as the feed rolls peripheral speed. The rotational frequency of the feed rolls are the same. That means that the all feed rolls diameters must be also the same. From relations (1), (2) and (3) it is clear that for the correct realisation of the feed movement it is very important to maintain the friction coefficient between feed rolls and work piece as high as possible. On the other side the friction coefficient between work piece and working table must be as low as possible. The friction coefficient between feed rolls and the workpiece could be increased by using appropriate materials of the feed rolls (rubber rolls) or using the toothed made of steel rools. As it is well known the rubber rolls are used when the maschined surface must be protected from damage. Unfortunately, rubber rolls have rapid wear. After some time, due to the reduced diameter, their peripheral speed become less than peripheral spees of the toothed made of steel rolls. It means that rubber rolls starts to work as the brake.

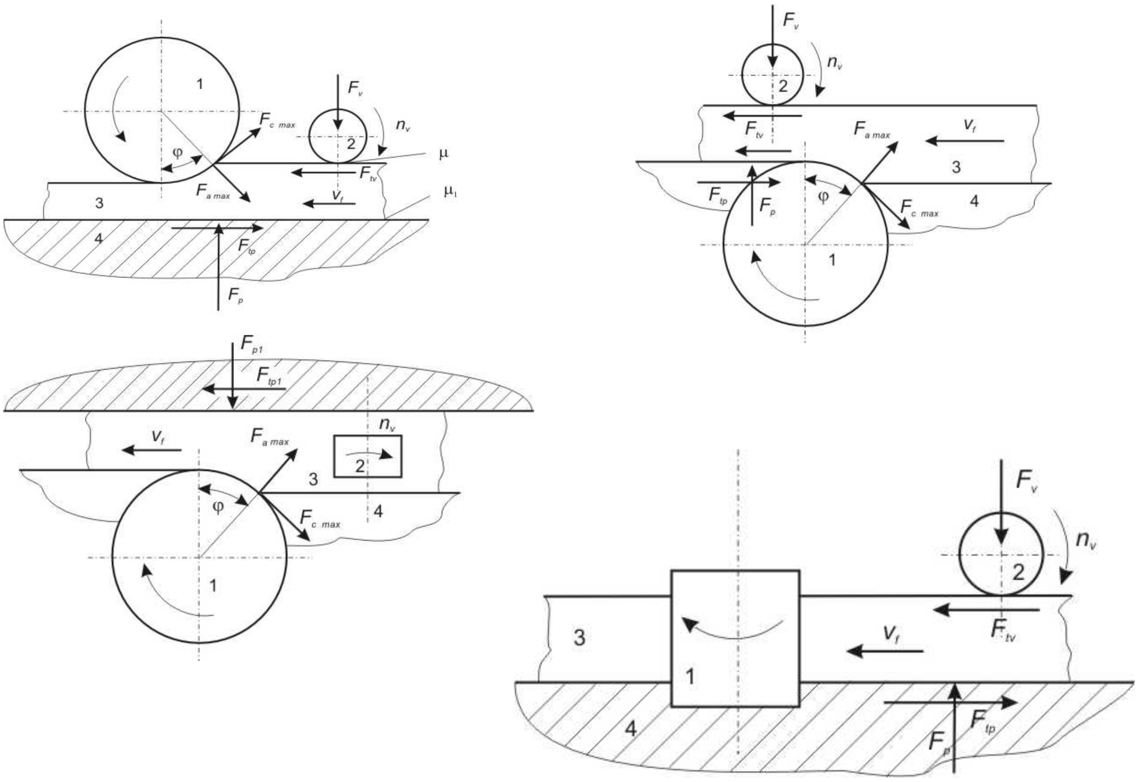

Fig. 2: The three typical cases of the feed movement resistences balance with friction between feed rolls and workpiece

Feed rolls slip measurement

The relations between peripheral speeds feed rolls were measured on the four side planing maschine in the plant conditions. The measerement were carried out at four diferent levels of the feed speed. The shematic representation of the four side planing maschine working space is shown on the fig. 3.

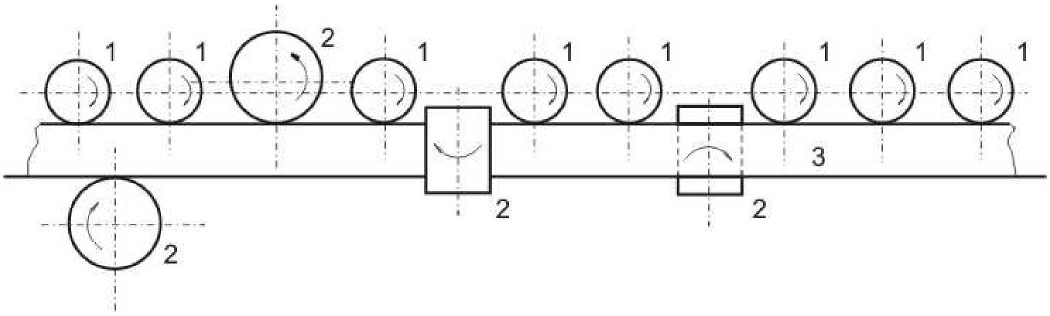

Fig. 3: Shematic representation of the four side planing maschine working space: 1 - feed rolls, 2 – planing heads, 3 – workpiece

Last two feed rolls are made of rubber. All other are toothed made of steel rools. The measurement were carried out on one feed roll made of rubber and on one toothed made of steel roll. Their rotational frequency was measured. At the same time, the workpiece feed speed was measured, too. The feed rolls slip was calculated as follows:

$$\delta = \frac{v_p - v_r}{v_r} \cdot 100\% \tag{4}$$

where v_p is feed rolls peripheral speed in *m/min*, v_r is real workpiece feed speed in *m/min*. The measurement results are giwen in table 1 and graphically represented in fig. 4.

Table 1. Peripheral speed of the feed rolls and workpiece feed speed measurement results

Measurement No.	**Feed rolls peripheral speed *m/min***		**Workpiece feed speed, *m/min***	**Slip, %**	
				Roll made of rubber	**Toothed roll made of steel**
1	9,15	9,77	9,15	0,00	6,78
2	10,98	11,04	10,59	3,62	7,64
3	13,97	14,66	13,32	4,90	10,04
4	15,87	17,10	13,55	17,14	26,23

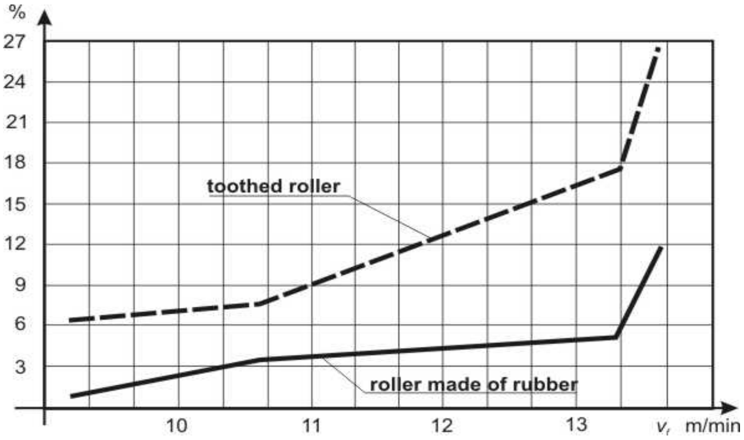

Fig. 4: Slip percentage of the rolls made of rubber and toothed feed rolls

Conclusion

It is evident that different feed rolls diameters cause the loss of energy. The total enery is increased and for that reason the maschine efficiency is reduced. Due to the incresed resistence in feed movement the maximum feed speed was limited. As the feed speed was increased the slip percentage on the monitored rolls was incresed, too. It means that at higher levels of feed speed the maschine own resistence will be also incresed.

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