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ROUNDUP OF RICKERS WITH BLADES ENABLING TO OBTAIN INDUSTRIAL CHIPS

In this study, we calculated the power indices in cylindering round timber with special knives, making it possible to receive the wood chips and formulate conclusions on the merits of the issue.

Introduction. According to the strategy of stable social and economic development of the republic till 2015 it is supposed to provide annual residential space with a total area of 2.8 – 3.3 millions of m2 and to expand these areas further. The solution of this question is directly connected to necessary growth of physical volume of wooden house building production and other kinds of joinery and construction products. And the wooden house production is closely connected to roundup timber.

Now the problem of manufacturing of the equipment allowing to make roundup timber of appropriate quality and reasonable price remains actual at present.

Obtaining industrial chips in the calculation of power indicators by rounding up wood. Calculation of power indicators is carried out taking into account the basic technical characteristics of a cutting tool. In this case the cutter is an active part of the cutting tool. The knife construction should meet the requirements imposed to industrial chips. And this construction is built-up.

The cutting element is a cutter of the U-shaped form which is fixed to the holder with two screws. The cutter has side-lay, basic cutting and lateral cutting edges.

Cutting angles affect the process of chip formation and they are chosen according to the cutting conditions.

The grinding angle b predetermines cutting characteristics of a cutter. A review of different kinds of resources and equipment operating experience on industrial chip obtaining has shown that the given corner can be in limits 40–45°.

For reduction of friction forces between a back surface of a cutter and a material it is recommended to form cutting angles with a back corner 12–15° for the operations of chip formation that is valid for cutting and basic edges. The undercutting edge practically does not contact with a processed material, therefore it is possible to recommend a back corner within 5–8°.

If such a construction is used, it is possible to simplify the installation and controlled methods. Knifes can be installed helically in special stands in one or two rows. Quantity of cutting elements and lane depend on diameter of processed logs and their lengths.

This instrument can be used for barking. In this case 1 or 2 knives with a floating knife system are installed, i.e. it is required to equip the machine tool with the follow-up device.

Axis velocity is determined by the formula:

$$V_S = S_Z \cdot z \cdot n / 1000, \text{ m/min} \quad (1)$$

where z – quantity of knifes; n – frequency of rotation of a rotor; S_Z – line feed on a knife ($S_Z = l_{ch}$), mm.

Speed of cutting is determined by the formula

$$V_P = \pi \cdot D_{log} \cdot n / 60 \cdot 1{,}000, \text{ m/s} \quad (2)$$

where D_{log} – diameter of a processed log, mm.

From the formula (1) it is possible to obtain the dependence of cutting elements quantity:

$$z = 1000 \cdot V_S / S_Z \cdot n.$$

The length of chips is regulated according to GOST 15.815-88, so for the manufacturing of wood-fiber plates length should be 10–35 mm, and thickness no more than 5 mm (for wood-particle board plates – 10–60 mm). It is assumed for counting S_Z = 35 mm. Then for frequencies of rotation of a rotor and axis velocity we will receive necessary quantity of cutting tools.

The quantity of cutting elements can be determined taking into account a thickness of a removed layer of wood:

$$h = D_{log} - d,$$

where d – diameter of the rough work piece, mm.

In this case

$$z = h / S_{ch}$$

The cutting force depends on its thickness and length. According to researches [1], the calculating formula is the following

$$F = 366 - 0.63 \cdot l_{ch} - 109.5 \cdot S_{ch} + $$
$$+ 1.88 \cdot l_{ch} \cdot S_{ch} + 14.3 \cdot S^2_{ch}, \text{ H.} \quad (3)$$

With l_{ch} = 35 mm and S_{ch} = 5 mm have:

$$F = 366 - 0.63 \cdot 35 - 109{,}5 \cdot 5 + 1.88 \times$$
$$\times 35 \cdot 5 + 14.3 \cdot 5^2 = 482.9 \text{ H.}$$

The foregoing formula is valid for processing of a pine wood by sharp cutters. It is necessary to consider adjustment factors in cases of processing other spices with the blunted cutters. Wood species adjustment factors are presented in the Table.

Wood species adjustment factors

coefficient	Softwood species						Hardwood species			
	Linden	Aspen	Fur-tree	Pine	Alder	Larch	Birch	Beech	Oak	Ash-tree
a_n	0.80	0.85	0.95	1.0	1.05	1.10	1.25	1.40	1.55	1.75

At bluntness of cutting elements, the adjustment factors makes $a_\rho = 1{,}6$.

As a result we have

$$F_\delta = F_c \cdot a_n \cdot a_\rho.$$

So, at birch processing with the blunted cutters shearing joint force of cutting will make

$$F_\delta = 482 \cdot 1.25 \cdot 1.6 = 965.8 \text{ H}.$$

Capacity of cutting is determine by the formula

$$P = F \cdot V \cdot z / 1{,}000 \cdot \eta,$$

where z – quantity of cutting elements; η – efficiency coefficient of a cutting mechanism ($\eta = 0.94$).

Since as the diameter of industrial chip and rough work piece is 150 mm with 1 knifes $z = 1$ we have:

$$V = \pi \cdot d \cdot n / 60 \cdot 1{,}000 = 3.14 \cdot 150 \times$$
$$\times 300 / 60 \cdot 1{,}000 = 2.4 \text{ m/s}.$$

Drive capacity should be not less than

$$P_{\text{дв}} = 965.8 \cdot 2.4 \cdot 1/1000 \cdot 0.94 = 2.5 \text{ kW}.$$

Conclusion. The suggested method has following advantages:

– enables to obtain industrial chips;

– using of one knife allowing to reduce power consumption;

– high processing quality;

– simplicity of adjustment of the cutting mechanism.

Disadvantages:

– efficiency is reached by sorting of logs and knife fixing.

References

1. Разработка технологии изготовления, подготовки к эксплуатации инструмента фрезерно-брусующих машин серии БРМ, тема 83-84: отчет о НИР; рук. темы И. Г. Лахтанов. – Минск: БТИ, 1985.

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