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UDC 674 ***Assoc. prof. S.V. Gayda, senior teacher Ya.M. Bilyy – UNFU***

The investigation of the shape stability of glued panels made of post-consumer wood

It has been established that in order to streamline the use of forest resources in Ukraine it is necessary to accelerate the adoption of laws on resource conservation and the use of secondary waste. These laws should effectively target enterprises to the ecological and rational consumption of resources, and hence to the development and application of low-waste and non-waste technologies, resource-saving and reliable technology. To do this, the laws must provide for measures of economic responsibility for the irrational use of resources, and for the destruction of business waste - fines. PCW (Post-Consumer Wood) is an additional resource suitable for material use, in particular in the production of panel elements. It was investigated that the shape stability of the combined PCW-made blockboards and the combined PCW-made furniture panels with the use of rails in the width of 20-40 mm, meets the requirements of the standard. The shape stability of the combined PCW-made blockboards is higher than the the combined PCW-made furniture panels for identical structures, in particular the assembly elements - rails. It has been established that in order to provide enterprises with PCW, it is possible, in addition to ordinary panel elements, to make combined ones. It is recommended to use rails of small widths up to 40 mm to increase the shape stability of shield assembly units.

Keywords: post-consumer wood, shape stability, PCW-made blockboard, PCW-made furniture panels, glued panels, technology.

UDC 674.053:621.02.001/53 ***Post-graduate I.O. Ben, assoc. prof. Y.I. Ozymok – UNFU***

ORBITAL GRINDING TOOL FOR SHARPENING WOODCUTTING KNIVES

On the ground of analysis and evaluation of grinding wheels for sharpening industry-used woodcutting knives, a new design of a grinding tool with an orbital drive is proposed. The use of orbital face grinding makes it possible to change the motion kinematics and realize intermittent grinding simultaneously, thus significantly improving the quality of thick knives deployment.

Keywords: knife, grinding tool, sharpening, orbital drive, intermittent grinding.

The development of the modern economy features an increased competition in markets where science has become a determining factor and a powerful productive force. In the industrial sector, particularly in the woodworking industry, the processing technology appears to be the productive force that determines the enterprise competitiveness. The progress of technology, namely the development and implementation of new materials, tools, methods and processes, as well as intensification of technological conditions, determine the qualitative and quantitative indicators of product and its cost.

Viewing the technology development as a science, one should note that in recent years it has won one of the key roles. One of such key roles in the technological science of materials processing by cutting is reserved by the technological processes of grinding wheel sharpening and whetting of woodcutting tools. Such wheels ensure high accuracy of shapes and sizes, low roughness of the work surfaces, ensuring their durability, and

thus the quality of the tool. The complexity of grinding process and its associated phenomena brings a need for in-depth theoretical and exploratory study of the physical nature of the phenomena occurring during the grind processing (sharpening) of the woodcutting tool. The essential academic work of the well-known scientists, P.I. Yashcheritsyn, E.N. Maslov, A.V. Yakimov, Y.N. Polyanchykov, A.N. Reznikov, D.R. Yevseyev, S.A. Popov, J.H. Filimonov, S.L. Khudobin, V.M. Shumyacher et al. allows for creating scientific basis of the grinding process, along with the development of the technological methods of grind processing that are widely and successfully applied in various branches of mechanical engineering, including woodworking. These academic papers and enterprise experience prove the ample opportunities of grinding processes in ensuring the high quality of the tool and machine parts during processing.

However, many factors that change over time compromise the stability of the grinding process. Furthermore, the sharpening method affects the productivity and quality of the woodcutting tool sharpening. Thereby, the development of intensive defect-free grinding processes on the basis of new constructive and technological solutions is a scientific challenge of great importance. Thick knives are sharpened on grinding machines TchN21-5, TchN31-4. To sharpen these tools, solid cup-shaped grinding wheels (GOST 2424-83) are used. Recommended wheel sizes, mm: diameter 150...250, thickness 63...100. The abrasive grains material – synthetic corundum, retinoid or ceramic bond, hardness – L...O, grain size – 16...40.

Typically, these knives are sharpened in two stages. At the first stage, the sharpening angle is formed and a wheel with a grain size of 40 is used to clear the notches. The second stage of sharpening is actually a whetting operation. A wheel with grain size 16 ... 25 on minimal feeds with intense cooling of the knife back surface allows surface roughness $R_a \leq 1{,}25$ microns. Both the sharpening and the replacement of grinding wheels make the process of knives deployment time-taking.

The disadvantages of solid grinding wheels encompass considerable waste load at the end of the wheel's life cycle, along with significant operational heat generation, and poor removal of grinding waste, which leads to smearing of the wheel and deteriorates grinding parameters, reducing the sharpening process productivity. Implementation of segmented grinding wheels did not yield the expected results regarding the improvement of the quality and efficiency of the woodcutting tools sharpening process.

The disadvantages of the segmental grinding wheel design are as follows: the grinding involves the unalterable abrasive segment surface, which leads to uneven wear of their surface. Thereby, there arises a need for frequent whetting of its surface or replacement of segments [1]. Taking into account the revealed drawbacks of known grinding tools and applying the method of morphological analysis (MA), the academic department of woodworking equipment and tools developed a prototype of a new orbital grinding tool. The cutting surface length calculation for various types of grinding wheels shows that the cutting surface length of the multi-cup grinding tool with drive cups is the largest (Fig. 1).

Overall view and a prototype of the orbital grinding tool is shown at Fig. 2.

The orbital grinding tool consists of a steel casing 1, with holes 2, where the bearings 3 are placed. The thread pins 4 are pressed in the bearing bores, being fixed by the thrust plate 5. The grinding cups 7 are placed on the pins between the two collars 6. A gear wheel 9 (a satellite) is key connected 8 at the opposite end of the thread pin.

The casing has a hub 10 with a conical hole for mounting on the grinding machine spindle. Upon the hub there's a press-fitted bearing 11 with a tooth gear 12 (central gear), which is immovable and flange mounted to the machine body.

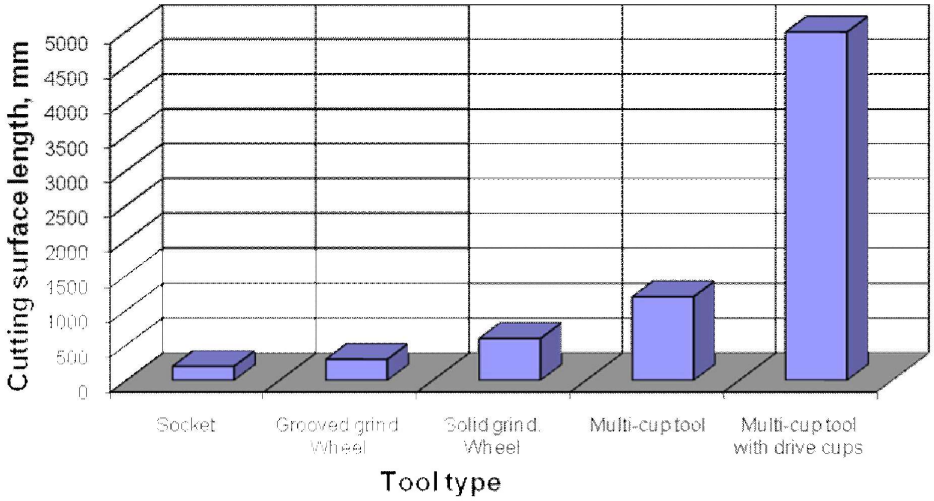


Fig. 1. Dependency graph for the cutting surface length and the grinding wheel type.

The tool has a protective cover 13, which is bolted 14 to the tooth gear 11 [4]. The tool works as follows. While the machine spindle (with the orbital grinding tool mounted on) rotates, the tooth gear 11 (central gear)remains immovable. The gears 8 (satellites) that mate with the tooth gear 11 drive the grinding cups 7. Due to this, the rotational direction of the grinding cups matches the rotational direction of the casing 1. When rotating, the cups' ends remove the allowance for sharpening. That way they wear out evenly and create a ventilation effect that intensively cools the tool being sharpened.

This will intensify the grinding process, increase productivity, improve the quality of the knife blade sharpness during sharpening, increase the operative durability of knives and the stability of the grinding tool.

Intensification of technological conditions for woodcutting tools sharpening determines the quality and quantity of product made, and reduces its cost.

The TTX of the orbital grinding tool are summarized in Table 1.

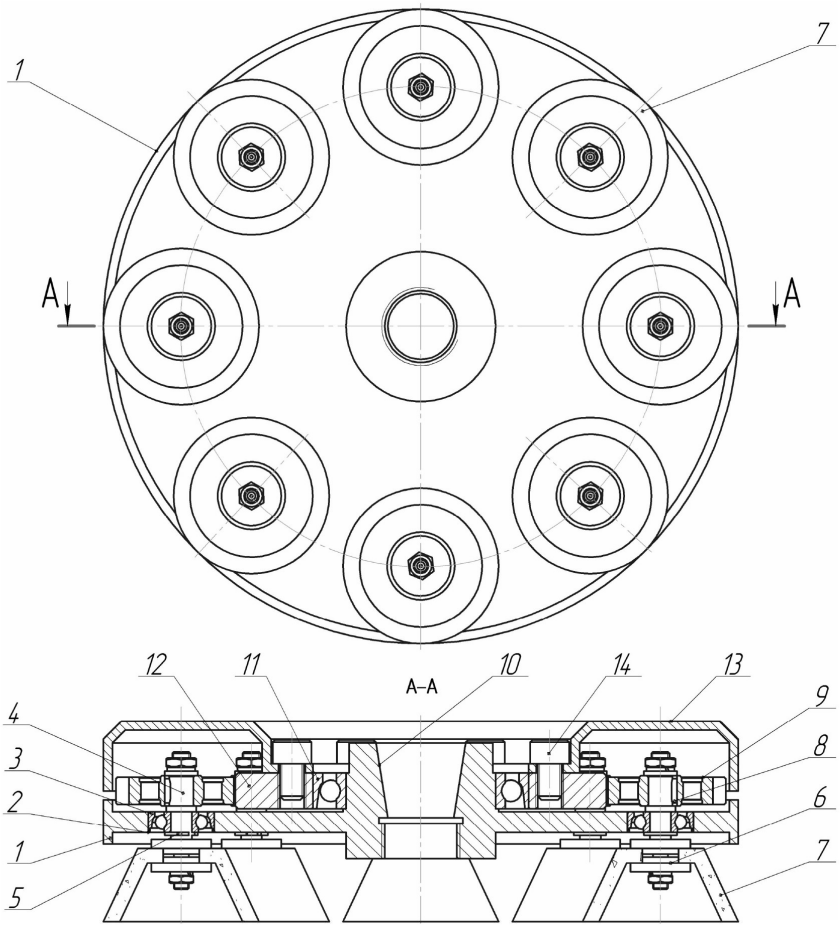
Table 1. TTX of the orbital grinding tool

Parameters	Value
1. Outside wheel diameter, mm	250
2. Wheel height, mm	50
3. Number of grinding cups, n	8
4. TTX of grinding cups: type	11, 6
abrasive grain	synthetic corundum, silicon carbide
bond	ceramic, retinoid
hardness	K
5. Cup sizes, mm : diameter / height	50 / 25
6. Cup drive type	orbital
7. Wheel weight, kg	5.0

The main advantages of the proposed tool design are as follows:

- significant increase in the cutting surface length, which is the largest when compared with other tools. At the same time, the intermittence index is the lowest;

- thermal field intermittence while sharpening;
- maximum use of the grinding cups' operational height;
- even wear (without trimming) of cups;
- cups of various grain and hardness;
- smooth tool cutting-in during sharpening due to the rotation of the grinding cups.



a)

b)

Fig.2. Orbital grinding tool for sharpening woodcutting planer knives: a – overall view; b – research prototype

Theoretical and exploratory research is required to select the best conditions for sharpening scoring knives with an orbital grinding tool.

Conclusions.

1. A new design of a an orbital grinding tool for grinding flat surfaces has been developed to ensure the contact intermittence of internal tools abrasive grains with the work surface in the cutting area.

2. Preliminary laboratory tests of an orbital grinding tool have yielded positive results.
3. Intensification of the knives sharpening conditions will provide a significant increase in productivity, improve quality and increase the overall durability of knives.

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Планетарний абразивний інструмент для загострення дереворізальних ножів

На основі аналізу і оцінки абразивних кругів для загострення дереворізальних ножів, що використовуються на підприємствах галузі, запропонована нова конструкція абразивного інструменту з планетарним приводом. Обґрунтовано, що застосування планетарного торцевого шліфування, дозволяє одночасно змінити кінематику руху, реалізувати перервне шліфування, що значно покращить якість підготовлення товстих ножів до роботи.

Ключові слова: ніж, абразивний інструмент, загострення, планетарний привод, перервне шліфування.

ДО ВІДОМА АВТОРІВ СТАТЕЙ

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